

FERTILITY MANAGEMENT OF THE CORN-SOYBEAN SUCCESSION CROPPING
SYSTEM AT THREE FLORIDA LOCATIONS

By

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Mild temperatures and a long frost-free growing period give the Southeastern U.S. a tremendous potential for multiple cropping. One system of considerable interest is the sequential growing of corn (Zea mays L.) and soybeans (Glycine max (L.) Merrill) in the same warm season. This study investigated the yield potential and fertility requirements of corn harvested for grain and for forage followed by soybeans at three Florida locations. Twelve N-P-K combinations were applied to the corn with one K-sidedress treatment applied to the soybeans. Soil and plant samples were taken during each crop growing season and analyzed for soil pH, double acid extractable P, K, Ca, and Mg and plant N, P, K, Ca, and Mg.

Corn responded to 168 kg of N/ha but not to 280 kg of N/ha or to P or K fertilization. Soybeans did not respond to fertilization but yields were 135 to 540 kg/ha higher following corn grain than following forage. This lack of response to fertilization was attributed to high native fertility levels in the soils studied. Two year averages of the three top yielding fertility treatments were as follows: Quincy - 113 qtl/ha (1 qtl = 100 kg) corn grain followed by 18.3 qtl/ha soybeans and 27.7

metric tons/ha corn forage followed by 16.3 qtl/ha soybeans; Gainesville - 77.6 qtl/ha corn grain followed by 20.9 qtl/ha soybeans and 18 metric tons/ha corn forage followed by 19.4 qtl/ha soybeans; Sanford - 68.3 qtl/ha corn grain followed by 30.1 qtl/ha soybeans and 16.2 metric tons/ha corn forage followed by 28.8 qtl/ha soybeans.

Corn earleaf N responded to applied N and K at all locations. No consistent response in earleaf P was noted, however, probably due to a wide variation in soil test P values among locations. The two corn hybrids differed significantly in earleaf concentrations of N, P, K, Ca, and Mg. Maximum nutrient removal in harvesting the corn forage occurred at Quincy, Florida, where 123 kg/ha, 21 kg/ha, and 149 kg/ha of N, P, and K were removed in the harvested corn forage. When soil-test K was high, considerably greater luxury consumption of K by the corn forage was noted.

Soybean leaf concentrations were not affected by fertilizer N or P applications on corn, but leaf K was higher on plots receiving 224 kg of K/ha than on those receiving only 112 kg of K/ha. The nutrient concentration of K in soybean leaves decreased with the application of N on corn while the concentrations of Ca and Mg increased. This indicated a significant interaction if K, Ca, and Mg was present under the three rates of N studied. In addition, the K concentration in soybean leaves following corn forage was lower than in soybean leaves following corn grain at high rates of N when no P or K was applied.

Chairman

INTRODUCTION

The challenge facing today's agronomist is to provide the knowledge needed to produce more food on a declining amount of arable land. Population continues to rise in the lesser developed nations at a rapid rate while the richer nations are demanding more meat in their diets. Between 400 and 500 kg of corn (Zea mays L.) are required to produce 100 kg of corn-fattened pork. The U.S. farmer experiences this as a constant and ready market for all the food grains he can produce, although prices are not always as high as he would like. Production inputs such as fertilizers, fuels, and equipment costs become more and more expensive while the prices received per unit of output rise only slowly. Farmers are forced to try and make up the difference by increasing the efficiency of farm operations and improving yields.

Given this situation, it is inevitable that farms will continue to be more and more intensively managed. In Florida, multiple cropping is likely to play a key role. By growing two or even three crops during the year, farmers can increase their total income. If irrigation facilities are installed, consistently high yields can be expected under good management and the farmer can thereby reduce the risk of economic damage by an extremely dry year while at the same time increasing his annual profit.

Florida's subtropical climate allows production of a wide variety of agricultural products. Beef cattle, citrus, winter vegetables, and field crops all play an important role in the state's economy. Field

crop production is centered in the northern and western areas where corn, soybeans (Glycine max (L.) Merrill), peanuts (Arachis hypogaea L.), and wheat (Triticum aestivum L.) are the principle crops grown. Much of the land lies fallow during a large portion of the year. Corn, peanuts, and watermelons (Citrullus lanatus (Thumbs) Mansf.) are usually grown as monocrops while wheat and soybeans are often grown sequentially in the same year. Soybeans may also be grown as the only crop in a year. With a frost-free growing season of over 240 days, the potential for multiple cropping in north and north central Florida is apparent. Many systems are currently being researched and the results are in demand. Management practices are different for multicropping systems than for conventional monocropping. Planting dates, tillage, herbicides, cultivars, and fertility requirements all vary to one degree or another, and the farmer cannot afford to use trial and error techniques in his own fields.

This study was initiated to determine the fertility requirements of growing corn followed by soybeans in the same warm season at three locations in Florida. Corn was grown for either grain or forage and followed by a late-maturing soybean variety. Twelve fertilizer treatments were applied; yield response, soil tests, and plant analysis were used to determine the optimum fertilizer application rate. The results of this study, when combined with research on other management practices, will help in formulating extension recommendations and increase the knowledge of sequential multicropping systems in Florida.

REVIEW OF LITERATURE

Multiple Cropping

Andrews and Kassam (3) defined multiple cropping as the intensification of cropping in time and space dimensions in which two or more crops are grown on the same field in a year. They recognized two major types of multiple cropping--intercropping and sequential cropping. Intercropping is the growing of two or more crops simultaneously in the same field. This can take any form from a random mixture of several crops planted together to the growing of crops in rows where rows (or groups of rows called strips) of one crop are alternated with rows or strips of another. Also included in the intercrop category is relay cropping in which the second crop is planted after the first has reached its reproductive stage but before it is ready for harvest. Intercropping is primarily found in the tropics where its advantages may include one or more of the following: higher total yields per unit of land, increased farm income, fewer insect problems, reduced risk of complete crop failure, more efficient use of solar radiation and nutrients, and improved nutritional diet for the farm family (24, 42, 49). The primary disadvantage of intercropping is the difficulty of mechanization. Unless machinery is developed which can effectively plant, cultivate, and harvest mixtures of crops, intercropping in the higher mechanized temperate zone countries will be limited to the planting of forage and pasture combinations and will have little role in field crop production.

In contrast to intercropping, sequential cropping is the growing of two or more crops in sequence on the same field during a year. Double cropping is the growing of two, triple cropping the growing of three, etc. Sequential cropping is found in both temperate and tropical areas. Because only one crop is in the field at any given time, mechanization is possible. The potential advantages of sequential cropping are similar to those of intercropping--greater annual production, more efficient use of solar radiation and nutrients, increased farm income, and reduced risk of total crop loss. Dalrymple (4) has reviewed the extent and types of multiple cropping found throughout the world. Additional information is found in Papendick et al. (43), Sanchez (49), and Bradfield (8). The success of different combinations is determined by local climatic, edaphic, and management variables.

The sequential growing of corn and soybeans has not been reported widely in the literature and nearly all the published work has been done in Florida. In a nonscientific article, Johnson (28) reports that one central Florida grower followed 94 qtl/ha corn with 30 qtl/ha soybeans (1 qtl = 100 kg). Rezende (46) reported yields of 23.7 qtl/ha for soybeans planted on 13 July at Gainesville. This is sufficiently late to allow a crop of corn to be grown and harvested prior to the soybeans. Guilarte et al. (21) report soybean yields of 32.1 qtl/ha and 14.3 qtl/ha for soybeans planted on 12 July and 5 August at Gainesville. Perez-Levy grew soybeans, peanuts, southernpea (Vigna unguiculata (L.) Turner), pigeonpea (Cajanus cajan (L.) Druce), and black bean (Phaseolus vulgaris L.) following corn at Gainesville, Florida, as double crops (45).

The management of a multiple cropping system such as this differs significantly from simply growing corn or soybeans as a full season

monocrop. Some of the factors which must be considered are planting population, row spacing, cultivars, tillage, herbicides used, and fertility management.

Planting Date

Monocropped corn is generally planted in March or April in north Florida. To maximize the useable growing season, multicropped corn must be planted as early in the year as possible. Aldrich (2) reports that a freeze during the early stages of growth does not kill corn and, in fact, may have little effect on later growth and final yield. Soybeans must be planted as soon as possible after the corn is harvested--usually in mid to late July. Smith (52), Guilarte (20), and Perez-Levy (45) all reported a reduction in yield of soybeans as the date of planting was delayed. The optimum planting date for monocropped soybeans in Florida is considered to be 15 May-15 June (27, 51). Perez-Levy planted "Jupiter" variety soybeans at Gainesville, Florida, on 12 July, 5 August, and 9 August and obtained yields of 40 qtl/ha, 24.9 qtl/ha, and 21.4 qtl/ha, respectively (45).

Water Management

Florida normally experiences a minor dry season in the spring and autumn which is accentuated on the sandy textured soils with low water holding capacities (9). Many farmers wait to plant until late spring when they can be sure of adequate rainfall. In a multicropping system, this delay in planting is impossible. Farmers must either invest in irrigation equipment, plant early and hope for a good year, or plan to multicrop on only those soils which have the best moisture holding capacities.

Plant Population

If irrigation is not available, lower plant populations may be needed to compensate for the anticipated lack of moisture during the growing season. In addition, late-planted soybeans were found to yield better when planted at higher than usual populations in Florida (46).

Row Spacing

Late planted soybeans do not grow as tall as full season beans and may fail to provide complete canopy closure when planted at normal row spacings (1, 20). Narrow rows are recommended for very late planted soybeans(46).

Cultivars

The corn hybrid chosen should be a short-season variety if grain is to be harvested before soybeans are planted. If the corn is to be ensiled, the farmer may either plant a full-season hybrid and harvest in mid July or plant an earlier maturing variety and harvest still earlier, thereby allowing him to plant the soybeans earlier and obtain greater bean yields. Akhanda et al. (1) recommend that double-cropped soybeans be selected from maturity group VIII or IX. They screened 24 breeding lines for yield when planted on 24 July and 8 August 1975, at Gainesville, Florida. Of these, the variety "Cobb" yielded highest. Group IX varieties did not mature until after 10 November which may be after the first frost occurs in some areas of north Florida.

Tillage

Minimum tillage is becoming more and more popular, especially in multicropping systems (17). It can save valuable time in getting the

soybeans established after corn is harvested and also eliminates the need for plowing under large quantities of fresh corn stover.

Herbicide Program

Certain herbicides commonly used on corn are toxic to soybeans (atrazine (2 chloro-4 ethylamino-6 isopropylamino-1,3,5 triazine) for example). The herbicide program for a corn-soybean multicropping system will differ somewhat from that used in a monocropping situation.

Fertility Management

Gallaher (16), Munsen (39), Oelsligle et al. (41), and others have pointed out the need for maintaining adequate soil fertility levels to assure proper crop nutrition throughout the full growing season. Gallaher stated that "double cropping means extra fertilizer will probably be needed compared to monocropping because a successful second crop will increase the amount of nutrients removed during the year." Determining the fertility requirements of corn followed by soybeans was the main purpose of this research. In order to evaluate this system, it was first necessary to know something about the fertility requirements of the individual crops.

Crop Nutrition--General

The nutrient status of soil is constantly changing. In an undisturbed ecosystem, nutrients accumulate in the surface soil and biomass until a dynamic equilibrium is reached where nutrients leave the system (through leaching, oxidation, herbivory, erosion, and other means) at the same rate they are supplied (through rain, animal feces, mineralization of organic matter, mineralization of soil, leaf fall, etc.).

Cropping of the soil upsets this balance. The soil is frequently bare and subject to rapid oxidation of organic matter. Leaching, erosion, and crop harvest all remove nutrients from the system. As the soil's fertility declines, yields of successive crops are reduced. Unless the balance is restored through the addition of soil ammendments, yields will plateau at a low level. At this point, the soil is once again in balance with the small quantities of nutrients removed in each harvest being equal to the nutrients supplied through rain, mineralization, and other processes. Multiple cropping involves intensive cropping and demands large amounts of nutrients. This invariably means the addition of fertilizers. In determining the quantities of fertilizers needed, it is necessary to know something about the requirements of the individual crops being grown. Several studies have shown that higher yields require more nutrients (Table 1). Tisdale and Nelson (55) stated that 268 kg of N/ha, 49 kg of P/ha, and 224 kg of K/ha are taken up by a corn crop yielding 113 qtl/ha of grain. Of this, 78 kg of N, 15 kg of P, and 179 kg of K are returned in the stover. This means that roughly 30, 30, and 80% of the N, P, and K, respectively, are returned to the soil and are potentially available for uptake by the following crop.

The nutrients required to produce various yields of soybeans are summarized in Table 2. Hanway and Webber (22) reported that 271 kg of N, 23 kg of P, and 94 kg of K are taken up by a 29 qtl/ha crop of soybeans. Of this, 90 kg of N, 6 kg of P, and 43 kg of K are returned to the soil if only the beans are removed. The percentage of N, P, and K returned to the soil are approximately 33, 24, and 45%, respectively.

An estimate of the absolute minimum quantity of nutrients needed for growing corn and soybeans can be calculated using the data in Tables

1 and 2. Over the course of a year, 178 kg of N/ha, 66 kg of P/ha, and 275 kg of K/ha will be removed from the system and must be replaced if corn is harvested for forage. The quantities are substantially less if only the grain is removed; only 100 kg of N/ha, 51 kg of P/ha, and 96 kg of K/ha are removed with the harvest each year. These quantities represent only the amounts of nutrients which are removed in a year and not the amounts of fertilizer which would be needed. The latter must take into account inefficiency of nutrient uptake, fixation of minerals by the soil, oxidation of organic N, leaching, and initial soil-test levels. Thus, the actual fertilizer recommendations will probably be greater (but may be less) than the amounts of nutrients removed.

In establishing the fertilizer recommendations for crops, two techniques are commonly employed--soil analysis and plant analysis. Soil analysis is used to predict the quantity of various nutrients which must be added to the soil for maximum yields. Plant analysis is used to ascertain the nutritional status of a crop while it is growing. Together, they provide a more complete picture of crop nutrition than when used alone. Reviews of both soil and plant analysis procedures are found in Walsh and Beaton (60), Sanchez (49), and Tisdale and Nelson (55).

Soil Analysis

The soil analysis procedure can be divided into four distinct parts:

1. Sampling
2. Analysis
3. Correlation with field and greenhouse tests
4. Interpretation and recommendations

The following discussion will be limited to soil testing for N, P, K, Ca, and Mg.

The first step in soil analysis is sampling. Sanchez (49) stated that taking a representative soil sample is the largest source of error in the soil fertility evaluation program. Ten to twenty subsamples are recommended and should include the complete rooting zone. Time of year has also been shown to affect the soil test results (54). After sampling, the soil is air dried, ground to a uniform particle size, and treated with one of several extractants. The most commonly used extractants are the double acid, Bray, and Olsen extractants (13). These extractants differ primarily in their abilities to extract meaningful quantities of P from the soil which correlate well with plant uptake.

The double-acid extractant (sometimes called North Carolina or Mehlich) consists of $0.05 \text{ N HCl} + 0.025 \text{ N H}_2\text{SO}_4$ and has a pH of 1.2. The acid causes rapid dissolution of Ca-phosphate (Ca-P) minerals so it is not recommended for use in alkaline soils or where substantial quantities of Ca-P minerals are suspected. Aluminum-phosphate minerals (Al-P) are dissolved more slowly and Fe-phosphates (Fe-P) hardly at all (54). Soils high in Fe oxides and clay give low P values because they neutralize the acid. The quantity of K extracted is similar to that found when $1.0 \text{ N NH}_4\text{OAc}$ at pH 7 (considered the standard extractant for K, Ca, and Mg) is used. Calcium and Mg minerals may be dissolved by the acid, thus giving higher values than those found with ammonium acetate (11).

There are two Bray extractants. Bray #1 consists of $0.03 \text{ N NH}_4\text{F}$ and 0.025 N HCl while Bray #2 consists of $0.03 \text{ N NH}_4\text{F}$ and 0.1 N HCl . They work well on soils with low to medium cation exchange capacities (CEC) which are moderately weathered or well weathered (49). Soils with free CaCO_3 or soils with high CEC and high percent base saturation will

neutralize the acid and lessen the effectiveness of the extractant. Doll and Lucas (13) stated that the extractant is effective in determining available K, Ca, and Mg. The extraction of P occurs when F^- ions complex Al and P is released. Because the pH is somewhat higher in Bray #2 than in the double-acid extractant, it dissolves basic Ca-P minerals such as hydroxyapatite more completely.

The Olsen bicarbonate extractant consists of 0.5 M $NaHCO_3$ buffered to pH 8.5. Sanchez (49) stated that it is applicable over a wider range of soil types than the other extractants for determination of P. It is the only extractant which releases much Fe-P. Within certain types of soils, however, P extracted by $NaHCO_3$ has not been as closely related to plant response as the P extracted by NH_4F-HCl (54). Because of the high pH, it is effective on alkaline soils and soils with medium to high CEC values. It is also well suited to soils with high degrees of base saturation or moderate amounts of Ca-P and free $CaCO_3$ (49, 54). The carbonate ions precipitate out Ca^{++} forming $CaCO_3$ and bringing Ca-P compounds into solution. Iron and Al phosphates are dissolved by the high pH. The $NaHCO_3$ is also an effective extractant for K, Ca, Mg, Zn, Mn, Fe, Cu, and NH_4-N (13).

Ammonium acetate is frequently mentioned as an excellent extractant for soil K, Ca, and Mg (13, 25), but it is rarely used for extraction of P. Bingham (6) surveyed all the U.S. land grant universities in 1961 and reported on the extractants used in soil-testing programs. Florida was the only state which used ammonium acetate buffered to a pH of 4.8 with acetic acid for extraction of P. Presumably, the mild acidity dissolves some Ca, Al, and Fe phosphates and the acetate ions complex

with Al and Fe to prevent readsorption of P. Florida has since changed to the double-acid extractant.

Once the soil is extracted, the solution is analyzed quantitatively and the results are correlated with field trials. It should be emphasized that the concentration of nutrients in the soil extractant is only a relative number and has no real meaning until correlated with greenhouse and field trials. Often, greenhouse tests show a strong correlation between soil-test values and yield or mineral uptake by plants while field trials show much greater variability. This is because yield is a function of many variables beyond the single nutrient under consideration (10). For this reason, soil-test results generally report the soil to be "high," "medium," or "low" in a particular element and recommendations are made by determining the amount of fertilizer which will bring the soil test nutrient levels to values associated with adequate yields. This quantity will depend on the crop and the soil type.

Plant Analysis

One objective of plant analysis is to determine if the nutrient concentration in a growing plant is adequate for maximum yield. Macy (35) first proposed this concept in 1936 and stated that "luxury consumption" of nutrients occurs above the critical percentages and little or no yield response can be correlated with the higher concentrations. Below the critical concentration, a zone of "poverty adjustment" was proposed where yield is reduced in proportion to a decrease in nutrient concentration. Tyner (56) recognized that the actual relationship between yield and nutrient concentration is curvilinear rather than linear. He assumed, however, that a linear relationship exists over

much of the range and used linear regression analysis to correlate yield with percent N, P, and K. He computed mathematical formulae for estimating yield as a function of nutrient concentrations but conceded that climatic variability could render the model useless, even when working with similar soils and crop varieties.

The concept of critical nutrient level has been modified since its conception to fit the realities of experimental data. Tyner (57) proposed critical levels in the sixth corn leaf at silking of 2.9% N, 0.295% P, and 1.30% K. Bennet et al. (5) found that the critical level of N in corn leaves varied from 2.6 to 3.1% in eight experiments. Dumenil (14) proposed that the critical N and P levels in corn do not occur at a single point or even over a narrow range of values. Instead, they include a wide range of values which reflect nutrient interactions and levels of other factors which interact with nutrient uptake.

More recently, Voss, Hanway, and Dumenil (58) measured corn grain yield and leaf N, P, and K concentrations on 575 plots at 23 sites in western Iowa. Multiple regression equations for yield as a function of linear, quadratic, and interaction terms for leaf N, P, and K resulted in an R^2 of only 0.24. By adding several environmental factors such as past cropping, plant population, soil moisture, soil yielding potential and interaction terms, they were able to improve the model considerably. They concluded that the observed grain yields could not be satisfactorily predicted by a regression model that contained only leaf N, P, and K concentration terms because yield was too much a function of soil, management, and climatic factors.

Peck et al. (44) demonstrated the influence of micronutrients and their interactions with macronutrients on yield. They reported an R^2

of 0.45 from fitting yield to nine linear and quadratic leaf N, P, and K concentration forms. Upon adding seven minor nutrients and interactions, an R^2 of 0.81 was obtained. The resulting model contained 37 terms, however, and interpretation of such relationships becomes a difficult task.

Gallaher (15) found differences in nutrient uptake and concentration of P, K, Ca, and Mg among different corn genotypes. In one instance, he found that the variety with highest P, K, Ca, and Mg concentrations in leaf tissue yielded the lowest of all inbreds studied. He also found significant differences in leaf concentrations among the same genotypes from year to year.

The only conclusion which can be drawn from such data is that there is no single "critical percentage" of a mineral element which is valid for different varieties grown on different soils under different environmental conditions. The best that can be expected is a wide range of values which will account for the influence of these factors. Such a range would be of little value in determining the nutritional status of crops which are only slightly deficient in a certain nutrient. It would, of course, be useful in detecting severe nutritional deficiencies. This is not to say that plant analysis isn't a useful tool in evaluating the nutritional status of crops, but simply that many factors must be considered. Generally, good correlations between nutrient concentration, yield, and nutrient supply are obtained at a specific location in a given year but the year to year and location to location influences on the relationship are often quite significant and difficult to determine. Munsen and Nelson (40) stated that plant analysis will probably become more important in the future. They predicted that the days of looking

only at N, P, and K concentrations are over and that factors such as micronutrients, irrigation, and date of planting will be considered. Through field tests and sampling of farmers fields, critical or optimal range values could be determined for specific hybrids or varieties grown in a particular area under specified management conditions. In conclusion, it is apparent that field trials and proper interpretation of results are as crucial in the success of a plant-analysis program as they are in soil analysis.

Nutrition of Corn

Corn does best on fertile, well drained, loamy soils with pH between 5.5 and 8.0 (37). Nutrient requirements are a function of moisture availability and plant population. Rhoads (47) obtained yields of 150 qtl/ha in Quincy, Florida, under ideal irrigation with the application of 336 kg of N/ha, 100 kg of P/ha, and 280 kg of K/ha. He concluded that corn yields in excess of 125 qtl/ha could consistently be produced in north Florida if all production practices were managed properly. Due to the sandy texture of most Florida mineral soils, it is best to apply the N in one or two sidedress applications.

Sampling of corn plants for the determination of nutrient concentrations has been the subject of many studies. Since the concentrations of nutrients vary with plant age, plant part being sampled and position on plant (30, 31, 59), these factors must be clearly specified when values are given. Jones et al. (31) recommended three sampling procedures for corn: (1) sample the complete above-ground portion of seedlings less than 30 cm.; (2) sample the first fully developed leaf

below the whorl just prior to tasseling; or (3) sample the entire leaf at the ear node (or immediately above or below it) between tasseling and the beginning of silking. Some nutrient concentrations found in the literature are summarized in Table 3. Several authors have suggested looking at the ratios of the concentrations of elements to each other (40). Some of the ratios looked at are N/K, N/P, Ca/P, Ca/K, and (Ca + Mg)/K. Dumenil (14) reported that the N/P balance in corn leaves at silking appears to be critical near the maximum yield. Vosset et al. (58) reported a nearly constant 10:1 ratio for %N:%P over a wide range from 3.5% N and 0.35% P to less than 2.5% N and 0.25% P in Iowa experiments. This ratio held true regardless of environmental effects, soil test, or fertilization.

Gallaher et al. (18) examined cation sums and ratios in corn and found the K/Ca, K/Mg and K/(Ca + Mg) ratios in corn leaves were dependent on age, fertilizer K applied, and yearly variations. Tissue Ca and Mg concentrations were found to decrease as a result of K application while tissue K concentration increased. Although it is obvious that nutrient interactions exist in plants, the effectiveness of using element ratios as a diagnostic tool needs to be evaluated more completely (40).

Nutrition of Soybeans

Soybeans grow best on soils of high fertility with a pH of 5.5 to 6.5 (48). Soybean response to direct fertilization has been generally small and inconsistent except on soils of low nutrient availability (22, 33). Well inoculated soybeans do not usually respond to N fertilization (32, 36) and response to P and K is variable. Florida Cooperative

Extension Service recommendations are for 40, 20, or 10 kg of P/ha on soils testing low, medium, or high in P and for 75, 37, or 19 kg of K/ha on soils low, medium, or high in K (61). Kamprath (33) reported that on three Alabama soils testing low in available K, soybean yields increased from 350 to 1350 kg/ha with the addition of K but no increase was obtained on soils with a medium or high soil test K. Maples (36) reported increases ranging from 270 to 880 kg/ha on soils with low soil test K in Arkansas. A response to P was obtained only when the soil test value was very low (less than 22 kg P/ha). On these soils, an application rate of 15 kg of P/ha was adequate for maximum yield. Jones, Lutz, and Smith (29) found that the application of either P or K increased nodulation and pod formation with a greater increase from K than P application. Maximum response was observed when both P and K were applied together. This experiment was conducted in Virginia. DeMooy et al. (12) compared the response of corn with that of soybeans when fertilized with P and K and the response of each to residual P and K in the soil. They found that corn was significantly more responsive to direct and residual fertilizer P and to direct application of K. Soybeans showed little difference between the effect of direct and residual fertilizer on yield. In addition, the following observations were reported: 1. only a small response from applied P and K fertilizers on land of low fertility was noted; 2. there was no response to anything greater than a maintenance rate of P fertilization; and 3. soybeans did not respond appreciatively to a second cycle of P and K fertilization applied during the following year although the soil remained low in P and low to medium in K. From this study conducted in Illinois, they concluded that soybeans have only

limited nutritional requirements. A more consistent response to fertilization has been noted in the southern part of the U.S.A. (50). In Georgia, Boswell and Anderson found that high rates of P and K (49 kg/ha and 93 kg/ha, respectively) resulted in significantly greater yields and larger seed size during each year of a 3-year study than low rates (24 kg/ha and 45 kg/ha) (22).

When sampling soybeans for nutrient concentrations, the stage of growth and plant part sampled are very important (53). Hanway and Weber report that N, P, and K concentrations will be influenced by the plant part chosen, position on the plant, stage of development and level of fertilization (23). Several studies have reported on the seasonal accumulation of nutrients in soybeans and the changes in leaf concentrations which occur over a growing season (22, 50). Melsted et al. (38) reported that significant plant composition differences have seldom been observed between different commercial varieties of soybeans and that any differences which are present can be minimized by analyzing the youngest mature leaves on the plant. Small and Ohlrogge (50) recommended samples be taken during the early bloom or early seed development stage and that the uppermost fully mature trifoliolate leaves be taken. Jones et al. (30) recommended sampling at the seedling stage (less than 30 cm high), or else prior to or during the initiation of flowering. They did not recommend sampling after the pods begin to set. Some values for soybean leaf samples found in the literature are presented in Table 4.

Several studies have demonstrated a significant effect on leaf nutrient concentrations as a result of fertilization (7, 23, 34). Nutrient interactions have also been reported. Hanway and Weber (23) found that application of N fertilizer to soybeans generally decreased

the P concentration and that N-deficient plants (nonnodulated) were high in P. Lutz and Jones (34) reported that liming tended to decrease the P and K concentrations in soybean leaves and that the concentration of K decreased as the rate of P fertilization increased. Boswell and Anderson (7) found that when N was applied without P or K, the K concentration in the tissue was reduced. By putting fertilizer N, P, and K, soil P, K, and pH, and year into a regression model for predicting yield, they obtained a relationship which was able to account for 65% of the variation in yield.

MATERIALS AND METHODS

The study was conducted at Sanford, Gainesville, and Quincy, Florida, during the years 1977 and 1978. Experiments at Sanford were located at the University of Florida Agricultural Research and Education Center (AREC) in Sanford on Immokolee fine sand (member of the sandy, silicious hyperthermic family of the arenic Haplaquods) which had previously been in vegetable production. Experiments at Gainesville were located at the University of Florida's Green Acres Agronomy Farm on Arrendondo loamy sand (member of the loamy, silicious hyperthermic family of the grossarenic Paleudults) which had previously been under bahiagrass (Paspalum notatum Flugge) sod. Experiments at Quincy were located at the University of Florida AREC in Quincy on Ruston loamy sand (member of the fine loamy, silicious thermic family of the typic Paleudults) which had previously been used for growing shade tobacco (Nicotiana tabacum L.).

Two systems were studied--corn for grain ("Funks G4507") followed by soybeans ("Cobb") and corn for forage ("Dekalb XL395") followed by soybeans ("Cobb"). These two systems were the whole plots in a split-plot experimental design. The split plots consisted of twelve N-P-K fertilizer treatments (Table 5). Nitrogen fertilizer was applied at planting and in two sidedress operations. The P fertilizer was applied at planting and the K fertilizer was applied in two applications as indicated. All fertilizer treatments were applied to the corn crop with the exception of treatment 12 which received a sidedress application of 112 kg of K/ha on the soybeans at early bloom. No other fertilizer

was applied to the soybeans. This experiment was replicated four times at each of the three locations over a 2-year period. A breakdown of the degrees of freedom is given in Table 6.

The land was moldboard plowed and double disc harrowed before each crop was planted. Varieties, row spacings, plant populations, herbicides, pesticides, and irrigation facilities used are presented in Table 7. Corn was planted as soon as the danger of frost had passed at each location. Planting date at Sanford was in late February, and at Gainesville and Quincy approximately 7 to 10 and 15 to 20 days later, respectively. Corn was harvested approximately 100 days after planting and the soybeans were planted as soon as the land could be prepared following corn harvest. Soybeans were harvested in November. Dates of planting, harvesting, and sampling are given in Table 8.

One set of soil samples was taken during each crop-growing season at each location. Nine cores were taken from the plow layer (0 to 18 cm) of each plot, air dried, and ground to pass through a 2 mm stainless steel sieve. Five grams of soil were weighed and extracted with 20 ml of double-acid extractant ($.05 \text{ N HCl} + 0.025 \text{ N H}_2\text{SO}_4$) for 5 minutes in an Eberback mechanical reciprocating shaker (160 oscillations/minute). The extracts were filtered through Whatman No. 6 filter paper and then stored in 25-ml vials under refrigeration until analyzed for P, K, Ca, and Mg. Phosphorus was determined colorimetrically using a Technicon Auto Analyzer. Potassium was determined by flame emission photometry and Ca and Mg were determined by atomic absorption spectrophotometry. Soil pH was determined for each sample using a Corning glass electrode potentiometer. A 1:2 soil to water ratio was used. This soil-water

mixture (50 ml) was stirred, left standing for one half hour, and stirred again prior to reading.

Corn leaf samples were taken during the early silk stage with the complete earleaf being taken from the lowest ear on 12 to 15 plants per plot. Soybean leaf samples were taken at early pod swell. The uppermost fully mature trifoliate leaves (without petioles) were selected from 20 to 30 plants on each plot. Forage samples were taken at harvest from each of the plots where corn was grown for forage. Five complete plants (less roots) were selected and analyzed for nutrient concentrations.

Plant samples were dried in forced-air forage dryers at 65°C for at least 48 hours. Leaf samples were ground either in a Wiley Mill (1 mm screen) or a Cristy Norris Mill which pulverized the sample. The samples were mixed thoroughly after grinding and dried again at 70°C for 24 hours before being stored in airtight sample bags. Forage samples had to be chopped twice in a mulching machine and subsampled before they could be ground in the smaller mills.

Nitrogen analysis was performed according to approved procedures (19). A 100-mg sample of the ground plant tissue was placed into a 75-mm pyrex digestion tube along with 3.4 g of prepared catalyst (90% anhydrous K_2SO_4 + 10% anhydrous $CuSO_4$), two or more Alundum boiling chips, and 10 ml of concentrated H_2SO_4 . The contents were mixed and a total of 2 ml of 30% H_2O_2 was carefully added in 0.5 ml, 0.5 ml, and 1 ml increments. The samples were allowed to stand for about 15 minutes until reaction of H_2O_2 ceased. Samples were digested at 385°C in an aluminum block as described by Gallaher et al. (19). The digested

solution was then diluted to 75 ml with distilled water and analyzed with a Technicon Auto Analyzer.

Phosphorus, K, Ca, and Mg were analyzed by routine methods. One gram of plant sample was placed into a 50 ml pyrex beaker and ashed at 480°C for 4 hours. A small amount of distilled water and 2 ml of HCl were added to the ash and this mixture was gently heated on a hotplate until dry. Following this, another 2 ml of HCl were added with 10 ml of distilled water. This mixture was covered with a watchglass and digested for one-half hour before being diluted to 100 ml and stored in a plastic vial. Phosphorus was determined colorimetrically using a Technicon Auto Analyzer. Potassium was determined by flame emission photometry and Ca and Mg were determined by atomic absorption spectrophotometry.

Statistical analysis of the data consisted of performing an analysis of variance for the effect of system and treatment on each factor measured (Table 9). In addition to the analysis of variance for differences between treatments, the data was broken into two subgroups. The first consisted of treatments 1, 2, and 3 where three rates of N were applied (0, 168, and 280 kg/ha) without any P or K. The effects of these three rates of N on yield and leaf nutrient concentrations was examined. The second subgroup was composed of treatments 4 to 11 which lent itself to analysis as a 2x2x2 factorial experiment with all combinations of the two higher rates of N (168 and 280 kg/ha), the two rates of P (56 and 112 kg/ha), and the two rates of K (112 and 224 kg/ha). The following regression model was used to evaluate the effects of year, N, P, K, and all interactions on yield: $\text{Yield} = \mu + \beta + \epsilon + \text{year} + \text{N} + \text{P} + \text{K} + \text{year}$

$\mu + \text{year} \times \text{P} + \text{year} \times \text{K} + \text{NxP} + \text{PxK} + \text{NxK} + \text{NxPxK} + \text{year} \times \text{NxP} + \text{year}$
 $\times \text{NxK} + \text{year} \times \text{PxK} + \text{year} \times \text{NxPxK}$. In this instance, μ is the overall
 mean, β is the block effect, and ϵ is an error term. Coefficients for
 the terms in the model were not determined, but the R^2 value was.

Throughout the tables in this text, treatment means with the same
 letter are not significantly different at $p = .05$ according to Duncan's
 New Multiple Range Test. System means marked with an asterisk are
 different at $p = .05$ when analyzed as the whole plots in a split plot
 experimental design. Where only one set of letters is given beside the
 two year average treatment mean, no system by treatment (system $\times$ treat-
 ment) interaction exists and the treatment differences are similar in
 the two systems. Where one set of letters is given for each system in
 the two year average analysis, a significant system $\times$ treatment inter-
 action was found and the two systems were, therefore, studied
 individually for treatment effects.

RESULTS AND DISCUSSION

Yields varied considerably between years and among locations (Tables 10 and 11)--a fact which can be explained by the quantity of water available during the corn growing season. Yields were low at Sanford during 1977 because of inadequate irrigation and a dry spring. The only treatment effect noticeable was a significantly lower grain yield on the check plots where no fertilizer was applied. Yields at Quincy were very high in 1977 because of excellent irrigation but were reduced in 1978 due to an unidentified disease which developed midway through the growing season. There was some effect of treatment on corn yields at Quincy during 1977 and this was accentuated during 1978. Even without fertilizer, however, corn grain yields were 100 qtl/ha during 1977 which was only 25% lower than the highest-yielding treatment. This high yield reflected the high native fertility levels of the land used in this study. It was previously well fertilized and used for shade tobacco production. Forage yields followed the same pattern as grain yields. In spite of the differences between treatments during both 1977 and 1978 at Sanford and Quincy, the analyses of variance for the two averages showed virtually no effect of treatment on yield. This was probably a result of a high coefficient of variability caused by the differences between years and does not accurately reflect the true situation. Corn grain and forage yields at Gainesville yielded significantly less over the 2-year period on the check plots where no fertilizer was applied.

To investigate further the effects of treatment on yield, treatments 1, 2, and 3 were analyzed as a subgroup to examine the effect of adding 0, 168, or 280 kg of N/ha without P or K. Both corn grain and corn forage responded to 168 but not to 280 kg of N/ha at all three locations (Table 12). Treatments 4 through 11 were also analyzed as a subgroup to determine the effect of two rates of N (168 vs. 280 kg/ha), two rates of P (56 vs. 112 kg/ha), and two rates of K (112 vs. 224 kg/ha) on yield. This analysis will be referred to as the 2x2x2 factorial analysis throughout the rest of this paper. Results are presented in Table 13 and indicated that there was no significant effect of N, P, K, or interactions on yield at Gainesville or Sanford. At Quincy, however, the effects of N, K, NxP, and NxK were all significant. This means that yields were significantly affected by N and K. In this instance, an examination of the means shows that yields were higher where the higher rate of N was applied but lower where the high rate of K was applied. These results indicated that a nutrient interaction occurred because on the plots where no P or K was applied, corn yield did not respond to 268 kg of N/ha but where P and K were applied, a yield response to the high rate was noted. A significant interaction term such as NxP or NxK indicated that the yield change due to N at the low rate of P or K was not the same as that which occurred at the high rate of P or K.

Soybean yields for 1977, 1978 and the 2-year average are presented in Tables 14 through 16. Yield was not influenced by treatment at Gainesville or Quincy. At Sanford, soybeans following corn grain were not affected by treatment but soybeans following corn forage were. The statistical analysis which was performed indicated simply that there was an overall difference between treatments. There was no one treatment

which consistently outyielded the others, but treatments 1, 2, and 3 appeared to be among the lowest yielding plots in all cases. This was, however, not a statistically significant difference. As this study progresses and the soil continues to be cropped on treatment plots 1, 2, and 3 where no P or K is added, this reduction in yield should become more pronounced.

A significant difference between systems was noted at Quincy and Sanford over the 2-year period. Soybean yields were consistently lower following corn forage than following corn grain. It could have been that the nutrients removed in the corn forage were of sufficient quantity to alter the soil's capacity for supplying adequate nutrients to the soybean crop. It is interesting to note that treatment 12 which included a sidedressing of K on the soybeans at early bloom, yielded no better than the other treatments. This would suggest that all fertilizer necessary for optimum yields could be applied to the corn crop and the residual fertility would be sufficient for the soybeans.

Average system yields for the 2-year period are presented in Table 17. Corn yields were primarily a function of the irrigation facilities available, but soybean yields were affected by the length of the growing season as well. Soybeans at Sanford were planted earlier in the summer than those at Gainesville and Quincy and yielded consistently higher. If a farmer wanted to increase his soybean yields at Quincy, he could plant a short-season corn hybrid and harvest it for forage. This would allow him to plant soybeans earlier in the summer and thereby increase the soybean yield potential. A system such as this (early harvested corn forage followed by soybeans) would be applicable all along the southern coastal region of the southeast U.S.

A revenue comparison of the two systems studied is given in Table 18. The actual income will vary according to yield and price variables, but using the values indicated in the table, corn for forage followed by soybeans would return a higher gross income per acre than corn grain followed by soybeans. In the corn grain-soybean system, the soybean crop was more valuable at Sanford, while the corn crop was more valuable at Gainesville and Quincy. In a multiple cropping system such as this, most of the production expenses can be attributed to the first crop. The second crop provides a considerable amount of additional revenue for only a small additional investment. When growing soybeans after corn, the extra expenses would consist of soybean seed, herbicides, pesticides, and the cost of planting. No additional fertilizer would be necessary.

The early planting of corn in this system assured a virtually pest-free growing season. No insecticides were used on the corn at Gainesville in 1978 and there were no insect problems. Under good management, the short-season hybrids planted early should yield as well as full-season monocropped corn in Florida. Soybean yields will be somewhat lower at Gainesville and Quincy than would be expected from full-season beans, but yields at Sanford should not differ much. Soybean yields of 30, 25, and 20 qtl/ha could consistently be produced following corn grain at Sanford, Gainesville, and Quincy, Florida, under the conditions of this study.

Leaf Analysis

Earleaf concentrations of all elements except P were influenced by treatment (Tables 19 through 33). The P concentrations were not

influenced by treatment at Sanford and were only slightly influenced at Quincy. The two hybrids differed significantly from each other in concentrations of all elements at Sanford and Gainesville. Only Ca concentrations in the two hybrids were significantly different at Quincy. To examine just how fertilization affected nutrient concentrations, the treatments were broken into two subgroups again. Nutrient concentrations as influenced by the three rates of N (without P or K) are given in Table 34. The first increment of N increased the N concentration in the corn leaves in every instance but the second increment resulted in a further increase only in the full-season hybrid at Quincy. Phosphorus concentrations in the corn leaves were not consistently affected by N fertilization. There was a tendency for the P concentration to increase with added N, but no meaningful conclusions could be drawn from the data. Potassium concentrations were not affected by N fertilization at Sanford or Gainesville, but increased with the first increment of N at Quincy. Apparently, the application of N allowed more K to be taken up by the plant. Potassium uptake was considerably increased because in addition to the higher concentration of K, there was an increase in dry-matter production, so the uptake and content of K in the crop (concentration x dry matter) was far greater on those plots which were fertilized with N. There was a tendency for N fertilization to cause a decrease in K concentration at Sanford and Gainesville, especially in System II where forage was harvested. This effect was much more pronounced in 1978 than in 1977 after 1 year of cropping and nutrient removal (see Tables 21 and 26). At Gainesville and Sanford, the N fertilizer caused an increase in dry matter production, but the soil's ability to supply K was limited so a dilution effect occurred and the concentration of K in the leaves was

lower. This was different from the situation at Quincy where soil K reserves were high and luxury consumption occurred.

Earleaf Ca and Mg concentrations increased when 168 kg/ha N was applied in almost every case. This increase was larger at Sanford and Gainesville than at Quincy, indicating that perhaps Ca and Mg were being absorbed in place of K. This hypothesis was further supported by the fact that there was a tendency for the Ca and Mg concentrations to be higher at Sanford and Gainesville (where the K earleaf concentrations were low) than at Quincy (where the K concentrations were high).

Earleaf N was significantly higher when the high rate of N was applied to both hybrids at Sanford and Gainesville and to the short-season hybrid at Quincy (Table 35). This is in contrast to the results found when N but no P or K were applied. In the latter case, there was no response to the second increment of N. Once again, this suggested that a nutrient interaction was present where the lack of one nutrient (K) inhibited uptake of another (N).

Corn-leaf P responded positively to the high rate of fertilizer P in System I at Sanford and in System II at Gainesville. Earleaf P also increased when the high rate of N was applied at Gainesville. These conclusions are of dubious value, however, because P concentration in the leaf tissue did not differ by much more than a few hundredths of one percent among treatments.

Earleaf K concentrations responded to the higher rate of K at Sanford and Gainesville but not at Quincy. Once again, this is a reflection of the higher soil K reserves at Quincy. At Sanford, earleaf K was depressed by the higher rate of P in System I and the same was

found at Gainesville in System II. Earleaf Ca was negatively correlated with K application rate at Gainesville. The higher K rate caused an increase in leaf K concentration and a decrease in Ca concentration. This demonstrated that a certain amount of competition between K and Ca was occurring. Interactions between Mg and K were also evident. Corn earleaf Mg was consistently higher where only the low rate of K was applied than where the high rate was applied at all locations.

In summary, the major trends in corn earleaf analysis were for N fertilization to increase earleaf N concentration and to decrease earleaf K concentration unless fertilizer K was applied or the soil had a high soil K level (as was the case at Quincy). An interaction was noted between K, Ca and Mg in which Ca and Mg concentrations were high when earleaf K was low. The addition of fertilizer K resulted in a decrease in earleaf Mg in almost every case and a decrease in earleaf Ca in both hybrids at Gainesville.

Soybean leaf N and P were not affected by treatment or system except in one case--soybean leaf N was significantly lower following corn forage than following corn grain at Quincy (Tables 36 through 50). Removal of the large quantity of forage grown at Quincy from the field in some way affected soybean development or nodulation enough to alter the leaf N concentration. This low N concentration may have been responsible for the reduced soybean yields which occurred in this system.

Soybean leaf K was lower in the corn forage-soybean system than in the grain-soybean system at all three locations. This indicated that removing the corn forage and associated K reduced the supply of K available for soybean uptake. Soybean leaf Ca and Mg were higher following

corn forage than following corn grain at Quincy. This would seem to suggest a cation interaction between Ca, Mg, and K in soybeans, just as in corn.

Treatment effects on soybean leaf K, Ca, and Mg were found to be significant so an analysis of variance was performed on treatments 4 through 11 to ascertain the individual effects of N, P, and K on leaf nutrient concentrations. The F values for this analysis are presented in Table 51. Although several significant F values are shown, a close examination of the treatment means shows no consistent effects of fertilizer N, P, or K on leaf concentrations of N or P. Soybean leaf K was significantly higher where the high rate of K was applied at Sanford and Gainesville but not at Quincy. This is exactly analogous to the effect of treatment on corn earleaf K concentration. Also similar is the way Ca and Mg concentrations in the leaf are inversely related to applied fertilizer K. Treatments receiving the high rate of K fertilizer were lower in soybean leaf Ca and Mg than those receiving the low rate. Two additional points are also worth mentioning. First, the effect of K fertilizer rate on Ca and Mg concentrations was more pronounced in System II where corn forage and the associated nutrients were harvested than in System I where only the grain was removed. Second, soybean leaf Ca was much more influenced by K fertilization than leaf Mg while just the opposite was true in the corn. Corn earleaf Mg was more affected by the K fertilizer rate than was earleaf Ca. This would suggest either a different soil Ca:Mg ratio during the two growing seasons or perhaps a difference in the ability of the two crops to substitute one cation for another (in this case Ca or Mg for K).

Several other effects of fertilizer nutrients on soybean leaf K were noted, but they were inconsistent and unexplainable. The high rate of fertilizer N appeared to depress soybean leaf K concentrations at Gainesville. The high rate of P increased leaf K concentrations in System I at Gainesville but had just the opposite effect in System II. Results such as these are difficult to interpret and give little useable information.

Soil Analysis

Soil test results for all three locations over the 2-year period are given in Tables 52 through 63. The first set of samples was taken just prior to planting of corn in early spring, 1977. These samples show that the initial P and K soil levels in the soil were extremely high at Sanford and Quincy and were uniform across the 12 treatments. There were some initial treatment differences in soil Mg on System II plots at Sanford and a significant difference between the two systems in Ca soil levels at Quincy. The initial P and K levels at Gainesville were considerably lower but still would be classified as high. There is some indication that the initial soil-test K may have been different among the treatments in System II at Gainesville. The soil had been limed at all three locations so the pH was around 6.0 at Sanford and Quincy and 5.8 at Gainesville.

The 2 years of cropping had a significant effect on soil test levels at Sanford and Gainesville but little effect at Quincy. Because plots at the different locations responded differently over the 2-year period, they will be discussed individually.

Soil tests taken during the 1978 soybean growing season (September) at Sanford are given in Table 55. They showed that the soil changed over the two year period as a result of the fertilizer treatments applied. Soil K and Ca were significantly lower in System II where the forage was harvested. Treatment affected soil P and soil K in both systems. To investigate further these treatment effects, the treatments were broken into two groups. The effects of three rates of N without P or K (treatments 1 to 3) are shown in Table 64. No consistent trends can be seen in this data. If treatments 1 through 3 are compared with treatments 4 through 12, however, it is evident that the three treatments which received no P or K fertilizer are lower in these elements than the other nine treatments. Treatments 4 through 11 were also analyzed as a 2x2x2 factorial experiment to check for the influence of N, P, and K applications on soil test. The computed F values are given in Table 65. Two significant effects were noted in this analysis. The first was a reduction in pH on those plots receiving the high rate of N. This is not surprising because NH_4NO_3 was the form of N fertilizer used and it reacts to lower soil pH. The second effect was a higher soil K level on those plots which received the higher K fertilizer rate. This was only significant in System II where corn forage was harvested.

Certain trends in the soil-test results for Gainesville can be seen although they are not all statistically significant (Tables 56 through 59). Soil K at Gainesville was generally lower in System II than in System I, just as it was at Sanford. This was statistically significant only in the second set of soil samples taken in 1977, but the tendency was consistent throughout. The natural heterogeneity of soil samples

results in a large amount of variability and this can mask some treatment or system influences which may be present. In the second year, there was a tendency for soil K to be lower in treatments 1 through 3 where no K was applied. Data in Table 64 give the soil test results for the last set of samples taken and compare treatments 1, 2, and 3 for effect of fertilizer N. In System II, soil P and K seem to decrease as the amount of N applied increases. The cumulative effect of N, P, and K on soil-test values for samples taken in September 1978 are shown in Table 65. The higher rate of N caused a slight decrease in pH while the high rate of K increased soil pH in System I. Fertilizer P and K both had a positive effect on raising soil P levels. The higher rate of fertilizer K also resulted in a higher soil test K level. Soil Ca and Mg did not appear to have been affected by fertilizer treatment to any great extent.

The soil at Quincy was extremely fertile at the beginning of this study and even after 2 years of cropping there was little detectable change in fertility. There was a slight tendency for treatments 1 through 3 (which received no P or K) to be lower in K than the other treatments, especially during the soybean growing season. Even so, the soil-test K at Quincy was 4 to 5 times greater than at Gainesville where no response to K fertilizer was evident. Soil-test results were not significantly affected by fertility treatment as of late summer, 1978 (Tables 64 and 65). A significant difference between the two systems was evident, however. Soil-test P and K were higher in the corn grain-soybean system than in the corn forage-soybean system. Soil Ca and Mg levels were higher during 1978 because dolomite was applied prior to planting the corn in 1978. No micronutrient levels have been studied to date, but the

intensive cropping which is being practiced in this multicropping system will draw down the micronutrient reserves in the soil quickly and they could be a limiting factor in achieving consistently high yields.

Nutrient Removal

Nutrient removal was calculated for the corn forage system to get an idea of how quickly the soil is being mined of nutrients. This was computed by multiplying dry matter production times the concentration of nutrients in the forage. Forage nutrient concentrations are given in Tables 66 to 68 for the three locations and the 2 years. It is interesting to compare these nutrient concentrations with the corn earleaf concentrations taken midway through the growing season. The concentrations of N, K, and Ca in corn forage were roughly half what they were in the earleaf while P and Mg were about one-third lower. Forage N and P concentrations were similar among the locations but the K concentrations were higher at Quincy while the Ca and Mg concentrations were lower. This indicated that luxury consumption of K occurred at Quincy where the soil test K was high. The K concentration in Sanford forage was lower than that found at Quincy but higher than at Gainesville which correlated well with the intermediate level of soil K found there. The concentrations of N and K were relatively low at Gainesville in the 1978 forage crop. This was probably due to leaching of these nutrients by summer rains because the forage harvest was somewhat delayed past the optimum period.

The amount of N harvested ranged from 22 to 168 kg/ha depending on location, year, and treatment (Tables 69 through 71). The data are

widely variable for two reasons. First, it was difficult to obtain a completely homogeneous mix of all portions of the corn plant. Furthermore, the quantity of plant material analyzed was only 0.1 g for N and 1.0 g for P, K, Ca, and Mg. Secondly, when multiplying two measured variables (yield and concentration of nutrients) the variability among the individual measurements is compounded. Because of the high variability, it is difficult to note any consistent treatment effects. The check plots which received no fertilizer were almost always lower in all nutrients. In addition, treatments 2 and 3 which received N but no P or K tended to be low in K and slightly above average in Ca and Mg at Gainesville and Sanford. Finally, the quantity of K removed per ton of forage was well correlated with the soil-test level of K. Much more K was removed in a ton of forage at Quincy than at Gainesville, while the amount of Ca and Mg removed was higher at Gainesville. This indicates that considerable luxury consumption of K occurred at Quincy where the soil-test K was high. A dilution effect of N and K in the plant tissues was also noted at Gainesville and Sanford. When forage yields were low, the concentrations of N and K were high. When yields were high, the concentrations of these nutrients were low.

SUMMARY AND CONCLUSIONS

Corn grown in any area of Florida can be followed by a crop of soybeans. In central Florida, no reduction in yield from that expected of monocropped corn or soybeans will necessarily occur. In the northern part of the state, soybean yields may be somewhat lower than comparable monocropped soybeans due to the shorter growing season. Under good management, 125 qtl/ha corn grain can be grown followed by 30, 25, and 20 qtl/ha soybeans in central, north-central and north Florida, respectively. This study showed that corn responded to 168 kg of N/ha but no additional response was noted when 280 kg of N/ha was applied. There was no yield response to P or K on these soils which tested high in both nutrients. All the fertilizer needed for adequate nutrition of both crops was applied to the corn and there was no benefit derived from a sidedressing of K on the soybeans at early bloom. Water was found to be the single most important factor limiting yield of the system, making irrigation facilities a necessity for optimum yields because of the dry spring and autumn conditions in Florida. Soybeans were found to yield slightly higher when planted after corn grain than after corn forage.

Corn earleaf N and K concentrations were positively correlated with applied N and K. Soybean leaf K concentrations were also influenced by K fertilization of the previous corn crop. The K concentration in soybean leaves was somewhat lower in the corn forage-soybean system than in the corn grain-soybean system. This shows the effect

of the preceeding crop of corn on the soybeans. Finally, even after 2 years of cropping there was no significant reduction in the soil P or K level where only the low rates of P and K were applied. This indicates that in any case, no more than 56 kg of P and 112 kg of K/ha are justified.

TABLE 1

APPROXIMATE UPTAKE OF NUTRIENTS BY A CROP OF CORN

Part of Plant	Yield (qtl/ha)	Nutrients Removed (kg/ha)					Reference Cited
		N	P	K	Ca	Mg	
Grain	113	190	34	45		18	
Stover		78	15	179		38	(55)
Total		268	49	224		56	
Grain	94	129	31	39	1	11	
Stover		62	8	157	39	33	(4)
Total		191	39	196	40	44	
Grain	94	145	28	39	17	24	
Total		224	39	217	47	43	(37)
Grain	70	128	20	37	14	11	
Stover		72	14	93	17	13	(49)
Total		200	34	130	31	24	
Total	130	360	52	230		75	(10)
						50	

TABLE 2

APPROXIMATE UPTAKE OF NUTRIENTS BY A CROP OF SOYBEANS

Part of Plant	Yield (qtl/ha)	Nutrients Removed (kg/ha)					Reference Cited
		N	P	K	Ca	Mg	
Grain	40	283	24	81		19	(55)
Straw		94	8	54		11	
Total		377	32	135		30	
Grain	40	243	20	75	7	8	(48)
Straw		124	7	65	24	12	
Total		367	26	140	31	20	
Grain	37	251	20	98	21	16	(26)
Straw		41	3	45	28	9	
Total		292	23	143	49	25	
Total	30	210	25	110		14	(10)
Grain	29	181	17	51			(22)
Straw		90	6	43			
Total		271	23	94			

TABLE 3

NUTRIENT CONCENTRATIONS IN CORN EAR LEAVES REPORTED IN THE LITERATURE

Time of Sampling	Nutrient Concentrations (%)					Reference Cited
	N	P	K	Ca	Mg	
Tasseling	3.0	.25	1.7	.40	.25	(38)
Silking	2.8-3.5	.25-.40	1.7-2.5	.21-1.0	.21-.60	(30)
Silking	2.6-4.0	.25-.50	1.7-3.0	.21-1.0	.31-.50	(14)
Silking	2.7-3.5	.20-.40	1.7-2.5	.40-1.0	.20-.40	(31)
Silking	2.8-3.3	.25-.35	1.8-2.3	.25-.40	.25-.40	(4)

TABLE 4
NUTRIENT CONCENTRATIONS IN SOYBEAN LEAVES REPORTED IN THE LITERATURE

Sample Taken	Nutrient Concentrations (%)				Reference Cited
	N	P	K	Ca	
Youngest mature leaves and petioles on plant after first pod formation ^a	-	0.35	2.20	0.40	0.30 (38)
Uppermost fully developed trifoliolate leaves just prior to pod set. No petioles. ^b	4.25-5.50	0.26-0.50	1.71-2.50	0.36-2.00	0.26-1.00 (50)
Uppermost fully developed trifoliolate leaves at early pod set. Low Yield Samples ^c	4.40	0.36	1.94		(53)
Uppermost fully developed trifoliolate leaves at early pod set. High Yield Sample ^d	4.60	0.35	1.97		(23)
Trifoliolate leaves sampled at full bloom stage. ^e	4.70	.32	1.2		(30)

^aConcentrations given are said to be "critical values."

^bConcentrations given are said to be "sufficiency range."

^c $\bar{X}$ concentration of 879 low yielding samples.

^d $\bar{X}$ concentration of 366 high yielding samples.

^e $\bar{X}$ of 5 varieties over a 3 year period in Illinois.

TABLE 5
FERTILIZER TREATMENTS IMPOSED ON THE CORN PLOTS OF
CORN-SOYBEAN SUCCESSION SYSTEMS AT THREE LOCATIONS IN FLORIDA

Treatment	N ^a			p ^b		K ^c	
	At Plant	1st Sidedress	2nd	At Plant	At Plant	At Plant	1st Sidedress
				<u>kg/ha</u>			
1	0	0	0	0	0	0	0
2	56	56	56	0	0	0	0
3	56	112	112	0	0	0	0
4	56	56	56	56	112	112	0
5	56	56	56	56	112	112	112
6	56	56	56	112	112	112	0
7	56	56	56	112	112	112	112
8	56	112	112	56	112	112	0
9	56	112	112	56	112	112	112
10	56	112	112	112	112	112	0
11 ^d	56	112	112	112	112	112	112
12	56	112	112	112	112	112	0

^aN applied as NH_4NO_3 .

^bP applied as regular superphosphate in 1977, triple superphosphate in 1978.

^cK applied as KCl.

^dTreatment 12 received an additional 112 kg K/ha on soybean crop at early bloom stage.

TABLE 6
DEGREES OF FREEDOM AND SOURCES FOR THE SPLIT-PLOT
ARRANGEMENT WITHIN A LOCATION IN FLORIDA
FOR ONE YEAR'S DATA

SOURCE		df
Total overall (TO)	4R x 2WP x 12 FT - 1	= 95
Total whole plots (TWP)	4R x 2WP - 1	= 7
Replications (R)	4R - 1	= 3
WP	2WP - 1	= 1
Error (a)	dfR + dfWP = dfTWP	= 3
Total Split-Plot (TSP)	TO-TWP	= 88
Split Plot (SP)	12SP - 1	= 11
WP x SP	(2WP - 1) (12SP - 1)	= 11
Error (b)	dfSP + dfWP x SP - TSP	= 66

Replications = 4, whole plots are corn forage versus corn grain systems = 2, fertility treatments = 12.

TABLE 7

MANAGEMENT VARIABLES USED ON THE CORN-SOYBEAN SUCCESSION CROPPING SYSTEMS IN FLORIDA

Factor	Corn	Soybeans
Cultivar	Funks G-4507 a (grain) DeKalb XL-395 (forage)	"Cobb" (group VIII)
Row spacing	76 cm	76 cm
Plant population	74,000 plants/ha	25 plants/m
Herbicides	Lasso (alachlor) ^a	Lasso (alachlor) ^a + Lexone (metribuzin) ^b Lasso (alachlor) ^a + Treflan (trifluralin) ^c
Insecticides and Nematicides	Furadan (carbofuran) ^d Lannote (methomyl) ^e Sevin (carbaryl)	Toxaphene ^g Lannate (methomyl) ^e Orthene (acephate) ^h Furadan (carbofuran) ^d Nemacure (phenamiphos) ⁱ
Irrigation (Sanford)		Stationary sprinkler (risers)
Irrigation (Gainesville)		Traveling gun
Irrigation (Quincy)		Stationary overhead sprinkler

^a2-Chloro-2'-6' diethyl-N (methoxymethyl) - acetanilide^b4-amino-6-(1,1, dimethylethyl)-3-(methylthio)-1,2,4-triazin-5 (4H)-one^ca,a,a-Trifluoro-2,6,dinitro-N,N-dipropyl-p-toluidine^d2-3 dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate^eS-Methyl-N (methylcarbamoyloxy) thioacetimide^f1-Naphthyl N-methylcarbamate^gToxaphene is a mixture of several chlorinated hydrocarbons^hO,S-Dimethyl acetylphosphoramidothioateⁱEthyl 3-Methyl-4-(methylthiophenyl)(1-methylethyl)phosphoramidate

TABLE 8
PLANTING, SAMPLING, AND HARVEST DATES FOR THE
CORN-SOYBEAN SUCCESSION CROPPING STUDY

Year	Operation	Sanford	Gainesville	Quincy
1977	Soil samples	25-2	3-3	22-2
	Plant corn	25-2	4-3	11-3
	Corn ear leaf samples	19-5	25-5	31-5
	Harvest corn	27-6	30-6	18-7
	Soil samples	27-6	2-7	36-7
	Plant soybeans	18-7	11-7	31-7
	Soybean leaf samples	20-9	14-9	22-9
	Harvest soybeans	21-11	15-11	18-11
1978	Plant corn	1-3	11-3	15-3
	Soil samples	22-5	23-5	1-3
	Corn ear leaf samples	22-5	23-5	12-6
	Harvest corn	5-7	17-7	24-7
	Plant soybeans	19-7	22-7	26-7
	Soil samples	20-9	25-9	28-8
	Soybean leaf samples	20-9	25-9	30-9
	Harvest soybeans	27-11	7-11	28-11

TABLE 9
VARIABLES MEASURED IN THE CORN-SOYBEAN
SUCCESSION CROPPING STUDY

-
- ⁺1. Soil test for pH, P, K, Ca, and Mg (once during the corn and once during the soybean growing season).
 2. Corn ear leaf analysis for N, P, K, Ca and Mg.
 3. Corn forage analysis for N, P, K, Ca, and Mg.
 4. Corn grain yield (reported at 15.5% H₂O).
 5. Corn forage yield (reported as fresh forage wt.).
 6. Soybean leaf analysis for N, P, K, Ca, and Mg.
 7. Soybean yield (reported at 12% H₂O).
 - *8. Corn plant height at harvest.
 - *9. Corn plant population at harvest.
-

+Double-acid extractant

*This data reported in Appendices 1 and 2.

TABLE 10

CORN GRAIN YIELDS (QTL/HA) AT SANFORD, GAINESVILLE AND QUINCY

Treatment	Sanford	Gainesville	Quincy
<u>1977</u>			
1	18.9 b	9.9 b	100.0 c
2	43.1 a	67.1 a	126.7 ab
3	38.6 a	69.1 a	128.3 ab
4	45.8 a	62.6 a	124.8 ab
5	40.2 a	69.8 a	125.1 ab
6	42.3 a	76.4 a	125.4 ab
7	42.0 a	65.2 a	134.7 a
8	33.9 a	66.1 a	115.5 ab
9	39.1 a	48.4 a	121.0 ab
10	47.6 a	59.6 a	124.2 ab
11	44.7 a	70.1 a	124.7 ab
12	48.7 a	53.5 a	131.9 ab
Mean	40.4	59.8	123.4
<u>1978</u>			
1	36.9 b	20.3 b	41.5 d
2	86.7 a	72.9 a	100.0 a
3	67.3 a	80.1 a	100.2 a
4	78.1 a	73.5 a	86.3 abc
5	87.2 a	78.7 a	80.9 abc
6	88.0 a	83.0 a	74.0 bc
7	81.8 a	84.1 a	90.2 ab
8	71.7 a	77.0 a	66.8 c
9	94.0 a	72.7 a	73.7 bc
10	92.4 a	87.4 a	87.1 abc
11	85.7 a	87.1 a	85.4 abc
12	87.7 a	83.8 a	84.6 abc
Mean	79.8	75.0	80.9
<u>Two Year Average</u>			
1	27.9 a	15.1 b	70.7 a
2	64.9 a	70.0 a	113.3 a
3	53.0 a	74.6 a	114.2 a
4	62.1 a	68.1 a	105.5 a
5	63.7 a	74.2 a	103.0 a
6	65.1 a	79.7 a	99.8 a
7	61.9 a	74.7 a	112.4 a
8	52.8 a	71.6 a	91.2 a
9	66.6 a	60.5 a	97.4 a
10	70.1 a	73.5 a	105.6 a
11	65.2 a	78.6 a	105.0 a
12	68.2 a	68.7 a	108.3 a
Mean	60.1	67.4	102.2

TABLE 11

CORN FORAGE YIELDS (TONS/HA) AT SANFORD, GAINESVILLE AND QUINCY

Treatment	Sanford	Gainesville	Quincy
<u>1977</u>			
1	6.0 a	4.2 b	23.2 e
2	9.7 a	15.7 a	30.0 bcd
3	10.1 a	12.6 a	31.2 b
4	9.1 a	14.9 a	25.4 cde
5	9.1 a	14.6 a	28.5 bcd
6	7.8 a	15.1 a	26.7 bcde
7	8.9 a	14.3 a	30.2 bc
8	7.9 a	13.3 a	39.0 a
9	9.0 a	11.8 a	28.3 bcd
10	9.7 a	14.1 a	28.9 bcd
11	9.8 a	16.6 a	26.4 cde
12	9.4 a	11.5 a	28.7 bcd
Mean	8.9	13.3	28.9
<u>1978</u>			
1	8.5 b	8.0 e	12.9 b
2	19.2 a	17.0 cd	21.3 a
3	17.4 a	15.8 d	21.4 a
4	22.4 a	19.4 b	21.3 a
5	21.1 a	20.3 ab	19.3 a
6	20.4 a	19.0 bc	21.3 a
7	22.7 a	19.4 b	21.0 a
8	20.9 a	19.7 ab	21.7 a
9	19.4 a	21.1 ab	20.0 a
10	23.2 a	19.7 ab	24.2 a
11	21.4 a	22.0 a	20.0 a
12	23.5 a	20.7 ab	22.1 a
Mean	20.0	18.5	20.5
<u>Two Year Average</u>			
1	7.2 a	6.1 c	18.0 c
2	14.4 a	16.4 ab	25.6 ab
3	13.7 a	14.2 b	26.3 ab
4	15.7 a	17.2 ab	23.4 bc
5	15.1 a	17.5 ab	23.9 abc
6	14.1 a	17.0 ab	24.0 abc
7	15.8 a	16.8 ab	25.6 ab
8	14.4 a	16.5 ab	30.4 a
9	14.2 a	17.1 ab	24.1 abc
10	16.5 a	16.9 ab	26.5 ab
11	15.6 a	19.3 a	23.2 c
12	16.4 a	16.1 ab	25.4 ab
Mean	14.4	15.9	24.7

TABLE 12

CORN YIELDS AS INFLUENCED BY THREE RATES OF NITROGEN
AT THREE LOCATIONS IN FLORIDA (TWO YEAR AVERAGE)

N rate (kg/ha)	Location		
	Sanford	Gainesville	Quincy
<u>Corn grain yield (qtl/ha)</u>			
0	27.9 b	15.1 b	70.7 b
168	64.9 a	70.0 a	113.3 a
280	53.0 a	74.6 a	114.2 a
<u>Corn forage (metric tons/ha)</u>			
0	7.2 b	6.1 b	18.0 b
168	14.4 a	16.4 a	25.6 a
280	13.7 a	14.2 a	26.3 a

TABLE 13

ANALYSIS OF VARIANCE F VALUES FOR THE EFFECTS OF YEAR AND TWO RATES EACH OF N, P, AND K ON CORN YIELD AT THREE LOCATIONS (TWO YEAR AVERAGE)

Source	df	Sanford	Gainesville	Quincy
<u>Corn grain</u>				
N	1	0.0	0.4	2.6
P	1	1.2	2.6	3.7
K	1	0.2	0.1	1.4
NxP	1	0.9	0.7	1.9
PxK	1	2.3	0.8	0.4
NxK	1	0.5	0.7	0.1
Year	1	401**	12.7**	167**
<u>Corn forage</u>				
N	1	0.0	0.1	5.1*
P	1	0.8	1.1	0.5
K	1	0.0	1.3	5.3*
NxP	1	2.4	2.9	4.9*
PxK	1	0.3	0.6	1.5
NxK	1	0.6	1.1	12.8*
Year	1	254**	58.6**	88.2**

*indicates F test is significant at $.05 \leq p < .01$.

**indicates F test is significant at $.01 \leq p$.

TABLE 14

SOYBEAN YIELDS AT SANFORD DURING 1977, 1978, AND THE TWO YEAR AVERAGE

Treatment	System I (Following grain)	System II (Following forage)	Mean
<u>1977 (qtl/ha)</u>			
1	27.4 a	26.1 c	26.7
2	29.9 a	28.1 bc	29.0
3	30.8 a	27.3 bc	29.0
4	31.3 a	32.6 a	31.9
5	33.3 a	30.6 ab	31.9
6	31.8 a	27.7 bc	29.7
7	32.9 a	31.4 ab	32.2
8	31.3 a	29.0 abc	30.2
9	32.0 a	33.3 a	32.6
10	30.4 a	31.6 ab	31.0
11	31.6 a	30.1 abc	30.9
12	32.6 a	31.1 ab	31.9
Mean	*31.3	*29.9	30.6
<u>1978 (qtl/ha)</u>			
1	22.0 a	19.a cd	20.6
2	27.1 a	21.3 abcd	24.2
3	24.9 a	17.7 d	21.3
4	28.8 a	22.7 abcd	25.7
5	26.3 a	26.9 ab	26.6
6	28.0 a	24.1 abcd	26.1
7	22.3 a	27.8 a	26.1
8	27.4 a	25.3 abc	26.4
9	30.4 a	22.8 abcd	26.6
10	30.3 a	24.6 abc	27.5
11	26.5 a	20.8 bcd	23.6
12	26.7 a	23.3 abcd	25.0
Mean	26.7	23.0	24.8
<u>Two Year Average (qtl/ha)</u>			
1	24.7	22.7	23.7 c
2	28.5	24.7	26.6 abc
3	27.9	22.5	25.2 bc
4	30.1	27.7	28.8 ab
5	29.8	28.8	29.3 ab
6	29.9	25.9	27.9 ab
7	27.6	29.6	28.6 ab
8	29.4	27.2	28.3 ab
9	31.2	28.1	29.6 a
10	30.4	28.1	29.2 ab
11	29.1	25.5	27.3 ab
12	29.1	27.2	28.4 ab
Mean	29.0	26.5	27.7

*Indicates systems are significantly different at $p=.05$

TABLE 15
SOYBEAN YIELDS AT GAINESVILLE DURING 1977, 1978,
AND THE TWO YEAR AVERAGE

Treatment	System I (Following grain)	System II (Following forage)	Mean
<u>1977 (qt1/ha)</u>			
1	25.6 a	23.5 a	24.5
2	26.3 a	21.2 a	23.7
3	26.2 a	24.7 a	25.4
4	27.2 a	25.4 a	26.3
5	26.8 a	24.2 a	25.5
6	25.7 a	23.8 a	24.7
7	23.9 a	25.0 a	24.4
8	25.2 a	22.6 a	23.9
9	25.2 a	25.5 a	25.3
10	27.6 a	26.0 a	26.8
11	26.0 a	27.4 a	26.7
12	25.2 a	24.3 a	24.8
Mean	25.9	24.5	25.2
<u>1978 (qt1/ha)</u>			
1	13.8 a	12.4 a	13.1
2	15.8 a	11.6 a	13.7
3	13.0 a	9.1 a	11.0
4	13.2 a	13.1 a	13.1
5	13.1 a	12.9 a	13.0
6	15.1 a	12.9 a	14.0
7	13.4 a	12.4 a	12.9
8	13.5 a	12.0 a	12.7
9	13.0 a	11.7 a	12.3
10	14.7 a	11.4 a	13.1
11	15.3 a	13.1 a	14.2
12	14.8 a	11.9 a	13.4
Mean	14.1	12.0	13.1
<u>Two Year Average (qt1/ha)</u>			
1	19.7	17.9	18.8 a
2	21.0	16.4	18.7 a
3	19.6	16.9	18.2 a
4	20.1	19.3	19.7 a
5	20.0	18.6	19.3 a
6	20.4	18.3	19.4 a
7	18.6	18.7	18.7 a
8	19.3	17.3	18.3 a
9	19.1	18.6	18.8 a
10	21.1	18.7	19.9 a
11	20.7	20.3	20.5 a
12	20.0	18.1	19.1 a
Mean	20.0	18.3	19.1

TABLE 16

SOYBEAN YIELDS AT QUINCY DURING 1977, 1978, AND THE TWO YEAR AVERAGE

Treatment	System I (Following grain)	System II (Following forage)	Mean
<u>1977 (qtl/ha)</u>			
1	14.1 a	11.3 a	12.7
2	16.5 a	10.0 a	13.2
3	16.2 a	15.1 a	15.7
4	17.6 a	10.9 a	14.2
5	14.0 a	9.1 a	11.6
6	13.8 a	9.5 a	11.6
7	15.7 a	10.6 a	13.1
8	12.9 a	13.2 a	13.0
9	14.8 a	12.3 a	13.5
10	13.6 a	11.8 a	12.7
11	13.8 a	8.3 a	11.0
12	15.6 a	11.7 a	13.7
Mean	*14.9	*11.1	13.0
<u>1978 (qtl/ha)</u>			
1	20.5 a	18.3 a	19.4
2	19.9 a	16.8 a	18.3
3	21.0 a	20.1 a	20.6
4	18.5 a	20.4 a	19.4
5	17.5 a	16.1 a	16.8
6	19.9 a	16.6 a	18.3
7	17.6 a	15.1 a	16.4
8	17.7 a	17.6 a	17.7
9	20.4 a	16.7 a	18.6
10	20.1 a	19.8 a	20.0
11	22.4 a	20.8 a	21.6
12	20.7 a	17.9 a	19.3
Mean	19.7	18.0	18.9
<u>Two Year Average (qtl/ha)</u>			
1	17.3	14.8	16.0 a
2	18.2	13.4	15.8 a
3	18.6	17.6	18.1 a
4	18.0	15.6	16.8 a
5	15.8	12.6	14.2 a
6	16.9	13.0	15.0 a
7	16.6	12.8	14.7 a
8	15.3	15.4	15.4 a
9	17.6	14.5	16.1 a
10	16.8	15.8	16.3 a
11	18.1	14.6	16.3 a
12	18.1	14.8	16.5 a
Mean	*17.3	*14.6	15.9

*Indicates systems are significantly different at $p=.05$

TABLE 17

COMPARISON OF THE TWO CROPPING SYSTEM YIELDS AT
SANFORD, GAINESVILLE, AND QUINCY (TWO YEAR AVERAGE)

System	Crop	Sanford	Gainesville	Quincy
I	Corn grain (qtl/ha)	60.1 ⁺	67.4	102.2
	Soybeans after grain (qtl/ha)	29.0 a*	20.0 a	17.3 a
II	Corn forage (tons/ha)	14.4	15.9	24.7
	Soybeans after forage (qtl/ha)	26.5 b	18.3 a	14.6 b

+Average of twelve treatments.

*Within locations, means with the same letter are not significantly different at $p = .05$.

TABLE 18

REVENUE COMPARISON OF THE TWO CROPPING SYSTEMS AT
SANFORD, GAINESVILLE, AND QUINCY (TWO YEAR AVERAGE)

System*	Crop	Sanford	Gainesville	Quincy
I	Corn grain	\$ 511	\$ 572	\$ 869
	Soybeans	696	480	415
	Total	\$1207	\$1052	\$1284
II	Corn forage	\$ 916	\$1034	\$1606
	Soybeans	636	439	350
	Total	\$1552	\$1473	\$1956

*Average of twelve treatments.

Assumes \$8.50/qtl corn grain, \$24.00/qtl soybeans, and \$65/ton forage.
Figures given are gross return/ha.

TABLE 19
CORN EARLEAF NITROGEN CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.31 d	1.24 c	1.28
2	2.05 c	2.29 ab	2.17
3	2.17 abc	2.16 ab	2.16
4	2.10 bc	2.12 b	2.11
5	2.31 abc	1.99 b	2.15
6	2.16 abc	2.20 ab	2.18
7	2.21 abc	2.15 b	2.18
8	2.25 abc	2.27 ab	2.26
9	2.37 a	2.29 ab	2.33
10	2.33 ab	2.27 ab	2.30
11	2.30 abc	2.33 a	2.31
12	2.15 abc	2.25 ab	2.20
Mean	2.15	2.13	2.14
<u>1978</u>			
1	1.80 b	1.29 e	1.55
2	2.65 a	2.53 bc	2.59
3	2.71 a	2.63 abc	2.67
4	2.65 a	2.25 d	2.45
5	2.61 a	2.48 c	2.55
6	2.74 a	2.54 bc	2.64
7	2.76 a	2.49 c	2.63
8	2.81 a	2.68 abc	2.74
9	2.76 a	2.78 a	2.77
10	2.87 a	2.76 ab	2.82
11	2.83 a	2.81 a	2.82
12	2.73 a	2.59 abc	2.66
Mean	2.66	2.49	2.58
<u>Two Year Averages</u>			
1	1.56	1.27	1.41 c
2	2.35	2.41	2.38 ab
3	2.44	2.39	2.41 ab
4	2.37	2.18	2.28 b
5	2.46	2.23	2.35 ab
6	2.45	2.37	2.41 ab
7	2.49	2.32	2.40 ab
8	2.53	2.47	2.50 ab
9	2.57	2.53	2.55 a
10	2.60	2.52	2.56 a
11	2.56	2.57	2.56 a
12	2.44	2.42	2.43 ab
Mean	2.41	2.31	2.36

TABLE 20
CORN EARLEAF PHOSPHORUS CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.34 a	0.24 a	0.29
2	0.26 a	0.29 a	0.28
3	0.27 bc	0.27 a	0.27
4	0.29 bc	0.29 a	0.29
5	0.29 bc	0.28 a	0.28
6	0.30 ab	0.30 a	0.30
7	0.29 bc	0.30 a	0.29
8	0.30 ab	0.28 a	0.29
9	0.29 bc	0.30 a	0.29
10	0.29 bc	0.30 a	0.30
11	0.29 bc	0.30 a	0.29
12	0.30 ab	0.29 a	0.29
Mean	0.29	0.29	0.29
<u>1978</u>			
1	0.36 a	0.32 c	0.34
2	0.36 a	0.36 bc	0.36
3	0.37 a	0.35 bc	0.36
4	0.34 a	0.35 bc	0.35
5	0.34 a	0.35 bc	0.35
6	0.38 a	0.35 bc	0.36
7	0.36 a	0.36 bc	0.36
8	0.36 a	0.37 ab	0.36
9	0.35 a	0.37 ab	0.36
10	0.40 a	0.39 ab	0.39
11	0.39 a	0.41 a	0.40
12	0.36 a	0.34 bc	0.35
Mean	0.36	0.36	0.36
<u>Two Year Average</u>			
1	0.35	0.28	0.32 a
2	0.31	0.33	0.32 a
3	0.32	0.31	0.32 a
4	0.32	0.32	0.32 a
5	0.31	0.31	0.31 a
6	0.34	0.33	0.33 a
7	0.32	0.33	0.32 a
8	0.33	0.33	0.33 a
9	0.32	0.33	0.33 a
10	0.34	0.34	0.34 a
11	0.34	0.35	0.35 a
12	0.33	0.31	0.32 a
Mean	0.33	0.32	0.33

TABLE 21
CORN EARLEAF POTASSIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.95 abc	1.91 a	1.93
2	1.73 bc	1.91 a	1.82
3	1.93 ab	1.78 a	1.86
4	2.00 ab	2.01 a	2.00
5	2.11 a	2.16 a	2.13
6	1.75 bc	1.87 a	1.81
7	1.78 bc	1.85 a	1.81
8	1.91 ab	1.72 a	1.81
9	1.86 b	1.95 a	1.90
10	1.67 c	1.81 a	1.74
11	1.80 bc	1.75 a	1.77
12	1.81 bc	1.85 a	1.83
Mean	1.86	1.88	1.87
<u>1978</u>			
1	1.52 bc	1.72 c	1.62
2	1.42 c	1.25 d	1.33
3	1.37 c	1.23 d	1.30
4	2.13 a	1.78 bc	1.95
5	2.36 a	2.21 a	2.28
6	2.00 ab	2.04 abc	2.02
7	2.33 a	2.18 ab	2.26
8	2.16 a	1.77 bc	1.96
9	2.26 a	2.28 a	2.27
10	2.01 ab	2.05 abc	2.03
11	2.26 a	2.13 abc	2.20
12	2.21 a	2.11 abc	2.16
Mean	2.01	1.90	1.96
<u>Two Year Average</u>			
1	1.73	1.81	1.77 cd
2	1.58	1.58	1.58 d
3	1.65	1.51	1.58 d
4	2.06	1.90	1.98 abc
5	2.23	2.18	2.21 a
6	1.87	1.96	1.92 bc
7	2.06	2.01	2.03 ab
8	2.03	1.75	1.89 bc
9	2.06	2.11	2.09 ab
10	1.84	1.93	1.88 bc
11	2.03	1.94	1.98 abc
12	2.01	1.98	1.99 abc
Mean	1.93	1.89	1.91

TABLE 22
CORN EARLEAF CALCIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.48 c	0.34 b	0.41
2	0.80 ab	0.57 a	0.68
3	0.85 a	0.53 a	0.69
4	0.74 b	0.55 a	0.64
5	0.77 ab	0.50 a	0.64
6	0.76 ab	0.55 a	0.66
7	0.77 ab	0.54 a	0.66
8	0.74 ab	0.57 a	0.66
9	0.79 ab	0.53 a	0.66
10	0.75 ab	0.49 a	0.62
11	0.84 ab	0.55 a	0.69
12	0.79 ab	0.57 a	0.68
Mean	*0.76	*0.52	0.64
<u>1978</u>			
1	0.49 d	0.31 c	0.40
2	0.71 ab	0.56 ab	0.63
3	0.81 a	0.61 a	0.71
4	0.62 bcd	0.49 b	0.55
5	0.56 cd	0.46 b	0.51
6	0.60 bcd	0.55 ab	0.57
7	0.57 cd	0.45 b	0.51
8	0.71 ab	0.51 ab	0.61
9	0.60 bcd	0.49 b	0.54
10	0.71 ab	0.53 ab	0.62
11	0.64 bc	0.49 b	0.56
12	0.66 bc	0.52 ab	0.59
Mean	0.64	0.50	0.57
<u>Two Year Average</u>			
1	0.49	0.33	0.41 d
2	0.75	0.56	0.66 ab
3	0.83	0.57	0.70 a
4	0.68	0.52	0.60 bc
5	0.66	0.48	0.57 c
6	0.68	0.55	0.61 bc
7	0.67	0.50	0.58 bc
8	0.73	0.54	0.63 abc
9	0.70	0.51	0.60 bc
10	0.73	0.51	0.62 bc
11	0.74	0.52	0.63 abc
12	0.72	0.54	0.63 abc
Mean	*0.70	*0.51	0.60

*Indicates systems are significantly different at $p=.05$

TABLE 23
CORN EARLEAF MAGNESIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.39 ab	0.25 b	0.32
2	0.41 a	0.32 a	0.36
3	0.37 abc	0.35 a	0.36
4	0.32 cd	0.27 ab	0.30
5	0.35 bcd	0.25 b	0.30
6	0.31 d	0.29 ab	0.30
7	0.31 d	0.25 b	0.28
8	0.32 cd	0.28 ab	0.30
9	0.32 cd	0.28 ab	0.30
10	0.29 d	0.25 b	0.27
11	0.29 d	0.25 b	0.27
12	0.30 d	0.26 ab	0.28
Mean	*0.34	*0.28	0.31
<u>1978</u>			
1	0.42 bc	0.27 bcd	0.35
2	0.62 a	0.55 a	0.58
3	0.58 ab	0.61 a	0.59
4	0.31 cd	0.32 bc	0.32
5	0.24 cd	0.24 bcd	0.24
6	0.32 cd	0.33 bc	0.32
7	0.22 cd	0.23 cd	0.22
8	0.31 cd	0.36 b	0.34
9	0.24 cd	0.19 d	0.21
10	0.30 cd	0.27 bcd	0.28
11	0.20 d	0.22 cd	0.21
12	0.35 cd	0.27 bcd	0.31
Mean	0.35	0.33	0.34
<u>Two Year Average</u>			
1	0.41	0.27	0.33 b
2	0.52	0.44	0.47 a
3	0.48	0.48	0.47 a
4	0.32	0.30	0.31 bcd
5	0.30	0.25	0.27 bcd
6	0.32	0.32	0.31 bcd
7	0.27	0.24	0.25 cd
8	0.32	0.33	0.32 bc
9	0.29	0.24	0.26 bcd
10	0.30	0.26	0.28 bcd
11	0.25	0.24	0.24 d
12	0.33	0.27	0.30 bcd
Mean	0.34	0.30	0.32

*Indicates systems are significantly different at $p=.05$

TABLE 24
CORN EARLEAF NITROGEN CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.55 b	1.27 c	1.41
2	2.66 a	2.54 b	2.60
3	2.79 a	2.73 ab	2.76
4	2.47 a	2.50 b	2.49
5	2.76 a	2.63 ab	2.69
6	2.73 a	2.63 ab	2.68
7	2.65 a	2.85 ab	2.75
8	2.89 a	3.00 a	2.95
9	2.80 a	2.67 ab	2.73
10	2.80 a	2.69 ab	2.75
11	2.80 a	2.81 ab	2.80
12	2.74 a	2.76 ab	2.75
Mean	*2.64	*2.59	2.62
<u>1978</u>			
1	1.48 d	0.98 e	1.23
2	2.49 ab	2.07 cd	2.28
3	2.69 a	2.31 ab	2.50
4	2.12 c	1.98 d	2.05
5	2.42 abc	1.91 d	2.16
6	2.48 ab	1.91 d	2.20
7	2.16 c	2.12 bcd	2.14
8	2.40 abc	2.29 abc	2.34
9	2.63 a	2.27 abc	2.45
10	2.54 a	2.32 ab	2.43
11	2.68 a	2.43 a	2.55
12	2.73 a	2.29 abc	2.51
Mean	*2.40	*2.08	2.24
<u>Two Year Average</u>			
1	1.51	1.13	1.32 c
2	2.57	2.30	2.44 ab
3	2.74	2.52	2.63 a
4	2.30	2.24	2.27 b
5	2.59	2.27	2.43 ab
6	2.60	2.27	2.44 ab
7	2.40	2.49	2.45 ab
8	2.65	2.64	2.64 a
9	2.71	2.47	2.59 a
10	2.67	2.51	2.59 a
11	2.74	2.62	2.68 a
12	2.73	2.53	2.63 a
Mean	*2.52	*2.34	2.43

*Indicates systems are significantly different at $p=.05$

TABLE 25
CORN EARLEAF PHOSPHORUS CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.27 c	0.23 c	0.25
2	0.30 ab	0.28 b	0.29
3	0.32 ab	0.28 b	0.30
4	0.31 ab	0.28 b	0.29
5	0.32 ab	0.29 ab	0.30
6	0.29 bc	0.29 ab	0.29
7	0.30 ab	0.30 ab	0.30
8	0.33 a	0.30 ab	0.32
9	0.31 ab	0.30 ab	0.31
10	0.33 a	0.30 ab	0.32
11	0.31 ab	0.31 a	0.31
12	0.31 ab	0.31 a	0.31
Mean	0.31	0.29	0.30
<u>1978</u>			
1	0.36 c	0.29 c	0.33
2	0.38 abc	0.31 bc	0.35
3	0.38 abc	0.36 a	0.37
4	0.37 bc	0.28 c	0.32
5	0.34 c	0.28 c	0.31
6	0.36 c	0.31 bc	0.34
7	0.35 c	0.33 ab	0.34
8	0.39 abc	0.34 ab	0.36
9	0.36 c	0.36 a	0.36
10	0.41 a	0.35 ab	0.38
11	0.39 abc	0.37 a	0.38
12	0.41 abc	0.35 ab	0.38
Mean	0.38	0.33	0.35
<u>Two Year Average</u>			
1	0.31	0.26	0.29 e
2	0.34	0.30	0.32 abcd
3	0.35	0.32	0.33 abcd
4	0.34	0.28	0.31 cde
5	0.33	0.28	0.31 de
6	0.33	0.30	0.31 bcde
7	0.33	0.32	0.32 abcd
8	0.36	0.32	0.34 abc
9	0.34	0.33	0.33 abcd
10	0.37	0.33	0.35 a
11	0.35	0.34	0.35 ab
12	0.36	0.33	0.35 a
Mean	* 0.34	* 0.31	0.33

*Indicates systems are significantly different at $p=.05$

TABLE 26
CORN EARLEAF POTASSIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	2.02 d	1.75 ef	1.88
2	2.07 d	1.50 g	1.78
3	2.07 d	1.70 fg	1.88
4	2.37 bc	2.05 bcd	2.21
5	2.57 ab	2.30 a	2.43
6	2.42 abc	1.95 cde	2.18
7	2.60 ab	2.37 a	2.48
8	2.35 a	2.17 abc	2.26
9	2.55 c	2.27 ab	2.41
10	2.45 abc	1.92 def	2.18
11	2.35 c	1.92 def	2.13
12	2.15 d	1.77 ef	1.96
Mean	*2.33	*1.98	2.15
<u>1978</u>			
1	1.85 b	1.47 c	1.66
2	1.85 b	1.20 d	1.52
3	1.60 b	1.17 d	1.38
4	2.25 a	1.77 b	2.01
5	2.42 a	2.00 a	2.21
6	2.25 a	1.75 b	2.00
7	2.35 a	2.02 a	2.18
8	2.22 a	1.75 b	1.98
9	2.52 a	2.00 a	2.26
10	2.32 a	1.57 bc	1.95
11	2.40 a	2.00 a	2.20
12	2.42 a	1.65 bc	2.03
Mean	*2.21	*1.70	1.95
<u>Two Year Average</u>			
1	1.93	1.61	1.77 d
2	1.96	1.35	1.65 d
3	1.83	1.43	1.63 d
4	2.31	1.91	2.11 bc
5	2.50	2.15	2.32 a
6	2.33	1.85	2.09 bc
7	2.47	2.20	2.33 a
8	2.28	1.96	2.12 bc
9	2.53	2.13	2.33 a
10	2.38	1.75	2.06 bc
11	2.37	1.96	2.16 b
12	2.28	1.71	2.00 c
Mean	*2.27	*1.84	2.05

*Indicates systems are significantly different at $p=.05$

TABLE 27
CORN EARLEAF CALCIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.44 d	0.31 c	0.37
2	0.65 abc	0.60 ab	0.63
3	0.64 abc	0.60 ab	0.62
4	0.67 ab	0.55 ab	0.61
5	0.65 abc	0.55 ab	0.60
6	0.72 a	0.59 ab	0.66
7	0.65 abc	0.52 b	0.58
8	0.67 ab	0.56 ab	0.62
9	0.61 bc	0.52 b	0.57
10	0.64 abc	0.58 ab	0.61
11	0.65 abc	0.59 ab	0.62
12	0.56 c	0.67 a	0.61
Mean	0.63	0.55	0.59
<u>1978</u>			
1	0.34 f	0.23 e	0.28
2	0.62 ab	0.53 b	0.58
3	0.67 a	0.66 a	0.66
4	0.46 e	0.39 bcd	0.48
5	0.52 cde	0.42 d	0.47
6	0.56 bcd	0.47 bcd	0.52
7	0.48 de	0.44 cd	0.46
8	0.58 abcd	0.52 b	0.55
9	0.53 bcde	0.47 bcd	0.50
10	0.60 abc	0.51 bc	0.55
11	0.56 bcde	0.50 bc	0.53
12	0.53 bcde	0.48 bcd	0.51
Mean	*0.54	*0.48	0.51
<u>Two Year Average</u>			
1	0.39	0.27	0.33 d
2	0.64	0.57	0.60 ab
3	0.66	0.63	0.64 a
4	0.57	0.52	0.54 bc
5	0.58	0.48	0.53 c
6	0.64	0.53	0.59 abc
7	0.57	0.48	0.52 c
8	0.62	0.54	0.58 abc
9	0.57	0.49	0.53 c
10	0.62	0.55	0.58 bc
11	0.61	0.54	0.57 bc
12	0.54	0.57	0.56 bc
Mean	*0.58	*0.51	0.55

*Indicates systems are significantly different at $p=.05$

TABLE 28
CORN EARLEAF MAGNESIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.21 cd	0.17 d	0.19
2	0.32 a	0.40 a	0.36
3	0.32 a	0.39 a	0.36
4	0.27 b	0.25 bc	0.26
5	0.24 bcd	0.23 c	0.23
6	0.25 bc	0.31 b	0.28
7	0.23 bcd	0.22 c	0.23
8	0.25 bcd	0.27 bc	0.26
9	0.22 bcd	0.26 bc	0.24
10	0.24 bcd	0.28 bc	0.26
11	0.21 d	0.26 bc	0.23
12	0.25 bcd	0.28 bc	0.26
Mean	*0.25	*0.28	0.27
<u>1978</u>			
1	0.26 d	0.22 e	0.24
2	0.42 b	0.52 b	0.47
3	0.48 a	0.62 a	0.55
4	0.27 cd	0.29 cde	0.28
5	0.23 de	0.22 e	0.22
6	0.23 de	0.30 cde	0.26
7	0.23 de	0.27 cde	0.25
8	0.32 c	0.34 cd	0.33
9	0.25 de	0.28 cde	0.26
10	0.26 d	0.35 c	0.31
11	0.17 f	0.24 de	0.21
12	0.20 ef	0.31 cde	0.25
Mean	*0.28	*0.33	0.31
<u>Two Year Average</u>			
1	0.24 bcd	0.20 d	0.21
2	0.37 a	0.46 a	0.41
3	0.41 a	0.51 a	0.45
4	0.27 bc	0.28 bc	0.27
5	0.24 bcd	0.22 cd	0.23
6	0.25 bc	0.31 b	0.27
7	0.24 bcd	0.25 bcd	0.24
8	0.29 b	0.31 b	0.29
9	0.24 bcd	0.28 bc	0.25
10	0.25 bc	0.32 b	0.28
11	0.19 d	0.26 bcd	0.22
12	0.23 d	0.30 b	0.26
Mean	*0.27	*0.31	0.29

*Indicates systems are significantly different at $p=.05$

TABLE 29
CORN EARLEAF NITROGEN CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	2.45 b	2.11 e	2.28
2	3.24 a	2.76 d	3.00
3	3.03 a	3.10 a	3.07
4	3.23 a	2.86 bcd	3.05
5	3.30 a	2.83 cd	3.06
6	3.24 a	2.92 bcd	3.08
7	3.34 a	2.89 bcd	3.11
8	3.29 a	3.00 abc	3.14
9	3.40 a	3.03 ab	3.22
10	3.43 a	3.00 abc	3.22
11	3.27 a	2.98 abc	3.12
12	3.27 a	2.88 bcd	3.07
Mean	*3.21	*2.87	3.04
<u>1978</u>			
1	1.69 d	1.59 c	1.64
2	2.87 abc	2.49 b	2.68
3	2.92 abc	2.80 a	2.86
4	2.90 abc	2.75 a	2.82
5	2.88 abc	2.59 ab	2.73
6	2.76 c	2.66 ab	2.71
7	2.83 bc	2.70 ab	2.76
8	2.94 ab	2.77 a	2.85
9	3.03 a	2.70 ab	2.87
10	2.90 abc	2.62 ab	2.76
11	2.94 ab	2.65 ab	2.79
12	2.85 bc	2.80 a	2.83
Mean	*2.80	*2.60	2.70
<u>Two Year Average</u>			
1	2.07	1.85	1.96 b
2	3.06	2.62	2.84 a
3	2.98	2.95	2.96 a
4	3.06	2.81	2.93 a
5	3.09	2.71	2.90 a
6	3.00	2.79	2.90 a
7	3.09	2.79	2.94 a
8	3.11	2.88	3.00 a
9	3.22	2.86	3.04 a
10	3.17	2.81	2.99 a
11	3.10	2.81	2.96 a
12	3.06	2.84	2.95 a
Mean	*3.00	*2.73	2.87

*Indicates systems are significantly different at $p = .05$

TABLE 30
CORN EARLEAF PHOSPHORUS CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.38 a	0.30 e	0.34
2	0.38 a	0.33 d	0.36
3	0.37 a	0.36 bc	0.37
4	0.36 a	0.35 cd	0.35
5	0.36 a	0.35 cd	0.35
6	0.37 a	0.34 d	0.36
7	0.38 a	0.37 bc	0.37
8	0.37 a	0.35 cd	0.36
9	0.37 a	0.37 bc	0.37
10	0.40 a	0.38 b	0.39
11	0.39 a	0.42 a	0.40
12	0.38 a	0.37 bc	0.37
Mean	*0.38	*0.36	0.37
<u>1978</u>			
1	0.34 a	0.29 b	0.32
2	0.36 a	0.34 a	0.35
3	0.35 a	0.35 a	0.35
4	0.35 a	0.36 a	0.36
5	0.36 a	0.36 a	0.36
6	0.37 a	0.36 a	0.37
7	0.35 a	0.37 a	0.36
8	0.36 a	0.34 a	0.35
9	0.36 a	0.36 a	0.36
10	0.37 a	0.34 a	0.36
11	0.37 a	0.33 a	0.35
12	0.35 a	0.35 a	0.35
Mean	0.36	0.35	0.35
<u>Two Year Average</u>			
1	0.36 a	0.29 c	0.33
2	0.37 a	0.34 b	0.35
3	0.36 a	0.36 ab	0.36
4	0.35 a	0.35 ab	0.35
5	0.36 a	0.36 ab	0.36
6	0.37 a	0.35 ab	0.36
7	0.37 a	0.37 ab	0.37
8	0.36 a	0.34 b	0.35
9	0.37 a	0.36 ab	0.36
10	0.38 a	0.36 ab	0.37
11	0.38 a	0.37 a	0.37
12	0.36 a	0.36 ab	0.36
Mean	*0.37	*0.35	0.36

*Indicates systems are significantly different at $p=.05$

TABLE 31
CORN EARLEAF POTASSIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	2.67 a	1.98 d	2.32
2	2.78 a	2.40 abc	2.59
3	2.77 a	2.24 c	2.51
4	2.88 a	2.38 abc	2.63
5	2.79 a	2.59 ab	2.69
6	2.96 a	2.54 ab	2.75
7	3.08 a	2.64 a	2.86
8	2.95 a	2.52 ab	2.73
9	2.91 a	2.34 bc	2.62
10	2.89 a	2.54 ab	2.71
11	2.79 a	2.46 abc	2.62
12	2.95 a	2.47 abc	2.71
Mean	*2.87	*2.43	2.65
<u>1978</u>			
1	2.43 d	1.95 e	2.19
2	2.82 bc	2.32 d	2.57
3	2.90 abc	2.50 cb	2.70
4	3.01 abc	2.63 abc	2.82
5	3.11 ab	2.68 abc	2.90
6	3.05 abc	2.75 ab	2.90
7	2.75 c	2.61 bc	2.68
8	3.06 abc	2.68 abc	2.87
9	3.06 abc	2.57 bc	2.81
10	3.06 abc	2.65 abc	2.85
11	3.18 a	2.85 a	3.01
12	3.02 abc	2.62 bc	2.82
Mean	*2.96	*2.57	2.76
<u>Two Year Average</u>			
1	2.55	1.97	2.26 d
2	2.80	2.36	2.58 c
3	2.83	2.37	2.60 bc
4	2.94	2.51	2.72 ab
5	2.95	2.64	2.79 a
6	3.00	2.64	2.82 a
7	2.91	2.62	2.77 a
8	3.00	2.60	2.80 a
9	2.98	2.45	2.72 abc
10	2.97	2.59	2.78 a
11	2.99	2.65	2.82 a
12	2.98	2.55	2.76 a
Mean	*2.91	*2.50	2.71

*Indicates systems are significantly different at $p=.05$

TABLE 32

CORN EARLEAF CALCIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.53 a	0.31 b	0.42
2	0.59 a	0.38 a	0.48
3	0.56 a	0.41 a	0.49
4	0.54 a	0.40 a	0.47
5	0.51 a	0.42 a	0.46
6	0.58 a	0.42 a	0.50
7	0.57 a	0.38 a	0.48
8	0.57 a	0.39 a	0.48
9	0.57 a	0.40 a	0.48
10	0.59 a	0.41 a	0.50
11	0.58 a	0.43 a	0.50
12	0.56 a	0.39 a	0.47
Mean	*0.56	*0.40	0.48
<u>1978</u>			
1	0.43 d	0.35 c	0.39
2	0.55 bc	0.52 ab	0.53
3	0.55 c	0.52 ab	0.53
4	0.57 bc	0.47 b	0.52
5	0.56 bc	0.47 b	0.52
6	0.59 abc	0.52 ab	0.55
7	0.57 bc	0.47 b	0.52
8	0.58 abc	0.47 b	0.52
9	0.60 ab	0.50 ab	0.55
10	0.62 a	0.54 a	0.58
11	0.63 a	0.49 ab	0.56
12	0.57 bc	0.51 ab	0.54
Mean	*0.57	*0.49	0.53
<u>Two Year Average</u>			
1	0.48	0.33	0.41 c
2	0.57	0.45	0.51 ab
3	0.55	0.47	0.51 ab
4	0.55	0.44	0.49 b
5	0.54	0.45	0.49 b
6	0.58	0.47	0.53 ab
7	0.57	0.43	0.50 ab
8	0.58	0.43	0.50 ab
9	0.58	0.45	0.52 ab
10	0.61	0.47	0.54 a
11	0.60	0.46	0.53 ab
12	0.56	0.45	0.50 ab
Mean	*0.56	*0.44	0.50

*Indicates systems are significantly different at p=.05

TABLE 33
CORN EARLEAF MAGNESIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.18 abcd	0.14 def	0.16
2	0.20 ab	0.16 bc	0.18
3	0.20 a	0.20 a	0.20
4	0.17 bcde	0.15 bcdef	0.16
5	0.15 e	0.14 cdef	0.14
6	0.17 bcde	0.15 bcde	0.16
7	0.15 de	0.12 f	0.14
8	0.19 abc	0.17 b	0.18
9	0.17 bcde	0.17 bc	0.17
10	0.16 cde	0.16 bcd	0.16
11	0.15 e	0.13 ef	0.14
12	0.17 bcde	0.15 bcdef	0.16
Mean	*0.18	*0.16	0.17
<u>1978</u>			
1	0.14 de	0.14 bcd	0.14
2	0.19 a	0.22 a	0.20
3	0.17 b	0.23 a	0.20
4	0.16 bc	0.15 bc	0.16
5	0.14 de	0.13 bcd	0.14
6	0.16 bcd	0.16 b	0.16
7	0.14 e	0.13 cd	0.13
8	0.15 cde	0.16 b	0.15
9	0.15 cde	0.14 bcd	0.14
10	0.14 e	0.15 b	0.15
11	0.14 e	0.12 d	0.13
12	0.14 de	0.14 bc	0.14
Mean	0.16	0.16	0.16
<u>Two Year Average</u>			
1	0.17 bc	0.14 de	0.15
2	0.20 a	0.19 b	0.19
3	0.19 a	0.22 a	0.20
4	0.17 b	0.15 cd	0.16
5	0.15 c	0.14 de	0.14
6	0.17 bc	0.16 cd	0.16
7	0.15 bc	0.13 e	0.14
8	0.17 b	0.17 c	0.16
9	0.17 bc	0.16 cd	0.16
10	0.15 bc	0.16 cd	0.15
11	0.15 bc	0.13 e	0.13
12	0.16 bc	0.15 cd	0.15
Mean	*0.17	*0.16	0.16

*Indicates systems are significantly different at $p=.05$

TABLE 34
NUTRIENT CONCENTRATIONS (%) IN CORN LEAVES AS INFLUENCED BY THREE RATES OF
NITROGEN AT THREE LOCATIONS (TWO YEAR AVERAGE)

Location	Hybrid [#]	N applied (kg/ha)	Nutrient concentration in leaves				
			N	P	K	Ca	Mg
Sanford	1	0	1.56 b	0.35 a	1.74 a	0.49 b	0.41 a
		168	2.36 a	0.32 a	1.58 a	0.76 a	0.52 a
		280	2.44 a	0.32 a	1.66 a	0.83 a	0.48 a
	2	0	1.27 b	0.29 a	1.82 a	0.33 b	0.27 b
		168	2.42 a	0.33 a	1.58 a	0.57 a	0.44 a
		280	2.40 a	0.32 a	1.51 a	0.58 a	0.48 a
Gainesville	1	0	1.52 b	0.32 b	1.94 a	0.39 b	0.24 b
		168	2.58 a	0.35 a	1.96 a	0.64 a	0.37 a
		280	2.74 a	0.36 a	1.84 a	0.66 a	0.41 a
	2	0	1.13 b	0.27 b	1.61 a	0.27 b	0.20 b
		168	2.31 a	0.30 ab	1.35 a	0.57 a	0.46 a
		280	2.53 a	0.32 a	1.44 a	0.63 a	0.51 a
Quincy	1	0	2.07 b	0.37 a	2.55 b	0.48 b	0.17 b
		168	3.06 a	0.38 a	2.81 a	0.57 a	0.19 a
		280	2.98 a	0.36 a	2.84 a	0.56 a	0.20 a
	2	0	1.85 c	0.30 c	1.97 b	0.35 b	0.14 b
		168	2.62 b	0.34 b	2.36 a	0.46 a	0.19 a
		280	2.95 a	0.36 a	2.37 a	0.47 a	0.22 a

[#] Hybrid 1 is Funks G-4507, a short season hybrid which was harvested for grain.
Hybrid 2 is DeKalb XL-395, a full season hybrid which was harvested for forage.
The two hybrids were significantly different ($p = .05$) in concentrations of all nutrients studied.

TABLE 35

ANALYSIS OF VARIANCE F VALUES FOR THE EFFECTS OF TWO RATES EACH OF
N, P, AND K ON CORN EARLEAF NUTRIENT CONCENTRATIONS (TWO YEAR AVERAGE)

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
<u>Corn earleaf N</u>							
N	1	7.8*	34.5*	15.8**	20.8**	10.5**	4.2 ⁺
P	1	1.0	4.4*	0.6	1.5	1.3	0.2
K	1	0.5	0.5	1.1	0.7	1.9	0.7
N x P	1	0.1	1.3	0.1	1.2	0.0	2.2
P x K	1	0.5	0.4	4.9*	5.1*	0.9	0.9
N ₂ x K	1	0.4	0.4	0.0	2.1	0.4	0.4
R ²		0.93	0.80	0.74	0.91	0.90	0.85
<u>Corn earleaf P</u>							
N	1	3.0	7.9*	28.1**	37.0**	2.5	0.2
P	1	8.7**	4.6*	0.0	12.6**	4.7*	2.5
K	1	1.7	0.3	7.6*	3.3 ⁺	0.1	5.4*
N x P	1	0.0	0.3	5.6*	2.8	0.0	1.0
P x K	1	0.2	0.0	0.1 ⁺	0.8	0.6	0.1
N ₂ x K	1	0.2	0.6	3.9	0.0	0.0	0.5
R ²		0.91	0.89	0.87	0.85	0.79	0.77
<u>Corn earleaf K</u>							
N	1	2.5	3.5 ⁺	0.8	4.3 ⁺	0.5	0.5 ⁺
P	1	12.0**	0.3	0.7	7.7*	0.0	4.0 ⁺
K	1	11.3**	17.8**	9.2*	45.4**	0.2	0.0
N x P	1	0.7	0.5	0.1	6.7*	0.1	0.2
P x K	1	1.1	12.0**	2.8	1.1	0.1	0.1
N ₂ x K	1	0.7	0.0	0.2	1.9	0.1	1.6
R ²		0.74	0.77	0.89	0.91	0.67	0.78

⁺ indicates F test is significant at $0.1 < p < .05$.

* indicates F test is significant at $.05 < p < .01$.

** indicates F test is significant at $.01 < p$.

TABLE 35 (continued)

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
<u>Corn earleaf Ca</u>							
N	1	9.7**	0.2	1.3	3.3 ⁺	8.0**	0.6 ⁺
P	1	0.7	0.1 ⁺	3.1	1.0	6.2*	3.9 ⁺
K	1	0.5	3.1 ⁺	6.7*	5.0*	0.5	0.9
N x P	1	0.4	1.0	0.3	0.6	0.1	0.9
P x K	1	0.4	0.1	0.9	0.2	0.1	6.1*
N ₂ K	1	0.0	0.9	0.0	0.4	0.8	0.9
R		0.88	0.53	0.84	0.83	0.75	0.82
<u>Corn earleaf Mg</u>							
N	1	0.7	1.2	0.4	5.6*	0.0	2.3
P	1	2.0	2.0	13.9**	1.6	4.7*	6.9*
K	1	7.7*	40.8** ⁺	25.6**	25.2**	12.1**	19.6**
N x P	1	0.2	4.2	2.9	2.5	4.7*	2.8 ⁺
P x K	1	0.4	1.5	0.1 ⁺	1.2	0.1	4.3 ⁺
N ₂ K	1	0.0	0.1	4.2	0.2	4.7*	0.0
R		0.82	0.85	0.90	0.87	0.86	0.87

TABLE 36
SOYBEAN LEAF NITROGEN CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	5.22 a	4.92 a	5.07
2	5.15 a	5.09 a	5.12
3	5.03 a	4.90 a	4.96
4	5.13 a	5.21 a	5.17
5	5.23 a	5.27 a	5.25
6	4.95 a	4.90 a	4.92
7	4.99 a	5.23 a	5.11
8	4.97 a	5.06 a	5.01
9	5.11 a	5.04 a	5.07
10	4.91 a	5.28 a	5.09
11	4.66 a	5.01 a	4.83
12	4.74 a	5.00 a	4.87
Mean	5.01	5.08	5.04
<u>1978</u>			
1	5.00 a	5.16 a	5.08
2	4.93 a	5.00 a	4.96
3	5.26 a	5.09 a	5.17
4	5.13 a	5.26 a	5.19
5	5.16 a	5.28 a	5.22
6	5.12 a	5.20 a	5.16
7	5.18 a	5.10 a	5.14
8	5.13 a	4.98 a	5.05
9	5.20 a	5.16 a	5.18
10	5.17 a	5.11 a	5.14
11	5.20 a	5.00 a	5.10
12	4.99 a	5.08 a	5.04
Mean	5.13	5.12	5.12
<u>Two Year Average</u>			
1	5.11	5.04	5.07 abc
2	5.04	5.05	5.04 bc
3	5.14	4.99	5.07 abc
4	5.13	5.23	5.18 ab
5	5.19	5.27	5.23 a
6	5.03	5.05	5.04 bc
7	5.09	5.17	5.13 abc
8	5.05	5.02	5.03 bc
9	5.15	5.10	5.13 abc
10	5.04	5.19	5.11 abc
11	4.93	5.01	4.97 c
12	4.87	5.04	4.95 c
Mean	5.07	5.10	5.08

TABLE 37
SOYBEAN LEAF PHOSPHORUS CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.33 a	0.33 a	0.33
2	0.35 a	0.34 a	0.34
3	0.35 a	0.33 a	0.34
4	0.34 a	0.36 a	0.35
5	0.34 a	0.34 a	0.34
6	0.36 a	0.35 a	0.36
7	0.36 a	0.35 a	0.35
8	0.35 a	0.35 a	0.35
9	0.36 a	0.35 a	0.36
10	0.37 a	0.36 a	0.36
11	0.36 a	0.36 a	0.36
12	0.35 a	0.35 a	0.35
Mean	0.35	0.35	0.35
<u>1978</u>			
1	0.38 a	0.39 a	0.38
2	0.35 a	0.36 a	0.36
3	0.35 a	0.37 a	0.36
4	0.37 a	0.38 a	0.37
5	0.37 a	0.40 a	0.38
6	0.42 a	0.42 a	0.42
7	0.41 a	0.39 a	0.40
8	0.39 a	0.39 a	0.39
9	0.39 a	0.41 a	0.40
10	0.41 a	0.42 a	0.42
11	0.41 a	0.41 a	0.41
12	0.37 a	0.37 a	0.37
Mean	0.39	0.39	0.39
<u>Two Year Average</u>			
1	0.36	0.36	0.36 cd
2	0.35	0.35	0.35 d
3	0.35	0.35	0.35 d
4	0.35	0.37	0.36 cd
5	0.36	0.37	0.36 bcd
6	0.39	0.39	0.39 a
7	0.39	0.37	0.38 abc
8	0.37	0.37	0.37 abcd
9	0.38	0.38	0.38 abc
10	0.39	0.39	0.39 a
11	0.38	0.38	0.38 ab
12	0.36	0.36	0.36 cd
Mean	0.37	0.37	0.37

TABLE 38
SOYBEAN LEAF POTASSIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.26 d	1.44 ab	1.35
2	1.28 cd	1.18 cd	1.23
3	1.33 bcd	1.11 d	1.22
4	1.49 abcd	1.45 ab	1.47
5	1.62 a	1.51 ab	1.56
6	1.47 abcd	1.39 abc	1.43
7	1.60 ab	1.49 ab	1.54
8	1.48 abcd	1.23 bc	1.35
9	1.63 a	1.42 ab	1.52
10	1.47 abcd	1.40 ab	1.44
11	1.53 abc	1.53 ab	1.53
12	1.59 ab	1.63 a	1.61
Mean	* 1.48	* 1.40	1.44
<u>1978</u>			
1	1.26 d	1.26 d	1.26
2	1.13 d	1.02 e	1.08
3	1.21 d	0.94 e	1.08
4	1.65 bc	1.36 cd	1.50
5	1.75 abc	1.71 a	1.73
6	1.54 c	1.32 d	1.43
7	1.98 a	1.66 ab	1.82
8	1.68 bc	1.28 d	1.48
9	1.86 ab	1.73 a	1.80
10	1.55 c	1.41 bcd	1.48
11	1.82 ab	1.57 abc	1.69
12	1.72 bc	1.65 ab	1.68
Mean	1.60	1.41	1.51
<u>Two Year Average</u>			
1	1.26	1.35	1.30 d
2	1.21	1.10	1.15 e
3	1.27	1.03	1.15 e
4	1.56	1.41	1.49 bc
5	1.68	1.61	1.65 a
6	1.50	1.36	1.43 cd
7	1.79	1.57	1.68 a
8	1.58	1.25	1.42 cd
9	1.75	1.57	1.66 a
10	1.51	1.41	1.46 c
11	1.67	1.55	1.61 ab
12	1.65	1.64	1.64 a
Mean	* 1.54	* 1.41	1.47

*Indicates systems are significantly different at $p=.05$

TABLE 39
SOYBEAN LEAF CALCIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.60 ab	1.46 a	1.53
2	1.70 a	1.62 a	1.66
3	1.53 abc	1.68 a	1.60
4	1.43 bcd	1.50 a	1.46
5	1.40 bcd	1.32 a	1.36
6	1.44 bcd	1.42 a	1.43
7	1.34 cd	1.41 a	1.38
8	1.25 d	1.50 a	1.37
9	1.35 cd	1.40 a	1.37
10	1.45 bcd	1.48 a	1.47
11	1.37 bcd	1.40 a	1.38
12	1.37 bcd	1.32 a	1.34
Mean	1.44	1.46	1.45
<u>1978</u>			
1	1.49 a	1.35 bcde	1.42
2	1.46 a	1.47 ab	1.46
3	1.32 ab	1.56 a	1.44
4	1.11 c	1.25 cdefg	1.18
5	1.12 c	1.13 fg	1.12
6	1.20 bc	1.36 bcd	1.28
7	1.09 c	1.20 defg	1.15
8	1.23 bc	1.41 abc	1.32
9	1.07 c	1.19 defg	1.13
10	1.20 bc	1.30 bcdef	1.25
11	1.07 c	1.07 g	1.07
12	1.16 bc	1.17 efg	1.16
Mean	1.22	1.29	1.25
<u>Two Year Average</u>			
1	1.55	1.41	1.48 ab
2	1.58	1.54	1.56 a
3	1.42	1.62	1.52 a
4	1.27	1.38	1.32 c
5	1.26	1.23	1.24 c
6	1.32	1.39	1.35 bc
7	1.22	1.31	1.26 c
8	1.24	1.46	1.35 bc
9	1.21	1.29	1.25 c
10	1.33	1.39	1.36 bc
11	1.22	1.23	1.23 c
12	1.27	1.24	1.25 c
Mean	1.33	1.38	1.35

TABLE 40
SOYBEAN LEAF MAGNESIUM CONCENTRATIONS (%) AT SANFORD

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.34 abc	0.33 abc	0.33
2	0.36 ab	0.37 ab	0.37
3	0.38 a	0.41 a	0.40
4	0.30 bc	0.32 abc	0.31
5	0.28 c	0.26 c	0.27
6	0.30 bc	0.31 bc	0.31
7	0.28 c	0.27 c	0.28
8	0.28 c	0.34 abc	0.31
9	0.27 c	0.31 bc	0.29
10	0.31 abc	0.29 bc	0.30
11	0.28 c	0.29 bc	0.28
12	0.31 bc	0.29 bc	0.30
Mean	0.31	0.32	0.32
<u>1978</u>			
1	0.52 a	0.48 b	0.50
2	0.44 a	0.53 ab	0.49
3	0.45 a	0.59 a	0.52
4	0.28 b	0.35 c	0.32
5	0.26 b	0.26 c	0.26
6	0.33 b	0.37 c	0.35
7	0.28 b	0.29 c	0.28
8	0.33 b	0.36 c	0.34
9	0.25 b	0.31 c	0.28
10	0.32 b	0.35 c	0.33
11	0.27 b	0.30 c	0.28
12	0.30 b	0.32 c	0.31
Mean	0.34	0.38	0.36
<u>Two Year Average</u>			
1	0.43	0.40	0.42 a
2	0.40	0.45	0.43 a
3	0.41	0.50	0.46 a
4	0.29	0.33	0.31 bc
5	0.27	0.26	0.27 c
6	0.32	0.34	0.33 b
7	0.28	0.28	0.28 bc
8	0.30	0.35	0.33 b
9	0.26	0.31	0.29 bc
10	0.32	0.32	0.32 bc
11	0.27	0.29	0.28 bc
12	0.30	0.30	0.30 bc
Mean	0.33	0.35	0.34

TABLE 41

SOYBEAN LEAF NITROGEN CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	5.03 a	4.82 a	4.92
2	4.82 a	4.81 a	4.82
3	4.79 a	4.45 a	4.62
4	4.73 a	4.88 a	4.81
5	4.65 a	4.95 a	4.80
6	4.86 a	4.81 a	4.83
7	5.03 a	4.88 a	4.96
8	4.77 a	4.78 a	4.78
9	4.78 a	4.73 a	4.75
10	4.93 a	4.73 a	4.83
11	4.92 a	4.85 a	4.88
12	4.92 a	4.81 a	4.87
Mean	4.85	4.79	4.82
<u>1978</u>			
1	4.51 a	4.87 a	4.69
2	4.74 a	4.75 a	4.74
3	4.75 a	4.82 a	4.78
4	4.86 a	5.07 a	4.96
5	4.45 a	5.04 a	4.74
6	4.67 a	4.55 a	4.61
7	4.59 a	4.99 a	4.79
8	4.68 a	4.90 a	4.79
9	4.87 a	4.86 a	4.87
10	4.79 a	4.79 a	4.79
11	4.43 a	4.83 a	4.63
12	4.67 a	4.79 a	4.73
Mean	4.66	4.85	4.76
<u>Two Year Average</u>			
1	4.77	4.85	4.81 a
2	4.78	4.78	4.78 a
3	4.77	4.64	4.70 a
4	4.79	4.97	4.88 a
5	4.55	5.00	4.77 a
6	4.76	4.68	4.72 a
7	4.81	4.93	4.87 a
8	4.72	4.84	4.78 a
9	4.83	4.80	4.81 a
10	4.86	4.76	4.81 a
11	4.68	4.84	4.76 a
12	4.79	4.80	4.80 a
Mean	4.76	4.82	4.79

TABLE 42
SOYBEAN LEAF PHOSPHORUS CONCENTRATIONS AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.35 a	0.35 a	0.35
2	0.36 a	0.37 a	0.36
3	0.36 a	0.35 a	0.36
4	0.37 a	0.36 a	0.37
5	0.38 a	0.35 a	0.36
6	0.35 a	0.35 a	0.35
7	0.37 a	0.36 a	0.36
8	0.35 a	0.35 a	0.35
9	0.34 a	0.35 a	0.34
10	0.35 a	0.34 a	0.35
11	0.36 a	0.37 a	0.36
12	0.36 a	0.35 a	0.36
Mean	0.36	0.35	0.36
<u>1978</u>			
1	0.37 a	0.36 a	0.37
2	0.37 a	0.37 a	0.37
3	0.38 a	0.38 a	0.38
4	0.39 a	0.39 a	0.39
5	0.37 a	0.41 a	0.39
6	0.38 a	0.37 a	0.38
7	0.37 a	0.40 a	0.39
8	0.38 a	0.39 a	0.39
9	0.39 a	0.38 a	0.39
10	0.38 a	0.40 a	0.39
11	0.36 a	0.41 a	0.39
12	0.36 a	0.39 a	0.38
Mean	0.38	0.39	0.38
<u>Two Year Average</u>			
1	0.36	0.36	0.36 a
2	0.36	0.37	0.37 a
3	0.37	0.37	0.37 a
4	0.38	0.38	0.38 a
5	0.37	0.38	0.38 a
6	0.37	0.36	0.37 a
7	0.37	0.38	0.38 a
8	0.37	0.37	0.37 a
9	0.36	0.37	0.36 a
10	0.36	0.37	0.37 a
11	0.36	0.39	0.37 a
12	0.36	0.37	0.37 a
Mean	0.37	0.37	0.37

TABLE 43

SOYBEAN LEAF POTASSIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.56 ab	1.34 bc	1.45
2	1.46 abc	1.13 de	1.30
3	1.29 d	1.04 e	1.17
4	1.49 abc	1.36 bc	1.42
5	1.52 abc	1.62 a	1.57
6	1.57 ab	1.40 bc	1.48
7	1.61 a	1.48 ab	1.55
8	1.35 cd	1.34 bc	1.35
9	1.44 abcd	1.27 cd	1.35
10	1.44 abcd	1.19 cde	1.31
11	1.42 bcd	1.22 cde	1.32
12	1.28 d	1.20 cde	1.24
Mean	1.45	1.30	1.82
<u>1978</u>			
1	1.47 cde	1.28 d	1.37
2	1.29 fg	1.05 e	1.17
3	1.28 g	1.01 e	1.14
4	1.64 ab	1.37 cd	1.51
5	1.59 bcd	1.65 a	1.62
6	1.61 bcd	1.33 cd	1.47
7	1.78 a	1.55 ab	1.66
8	1.38 efg	1.37 cd	1.37
9	1.63 abc	1.56 ab	1.59
10	1.41 efg	1.22 d	1.31
11	1.66 ab	1.46 bc	1.56
12	1.45 def	1.36 cd	1.40
Mean	1.52	1.35	1.44
<u>Two Year Average</u>			
1	1.52	1.31	1.41 bcd
2	1.38	1.09	1.23 fg
3	1.28	1.03	1.15 g
4	1.56	1.36	1.46 b
5	1.55	1.64	1.59 a
6	1.59	1.36	1.47 b
7	1.69	1.51	1.60 a
8	1.36	1.36	1.36 cde
9	1.54	1.41	1.47 b
10	1.43	1.20	1.31 ef
11	1.54	1.34	1.44 bc
12	1.36	1.28	1.32 def
Mean	1.49	1.33	1.41

TABLE 44
SOYBEAN LEAF CALCIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.22 a	1.27 d	1.25
2	1.35 a	1.56 ab	1.45
3	1.41 a	1.67 a	1.54
4	1.36 a	1.39 bcd	1.37
5	1.37 a	1.32 cd	1.34
6	1.47 a	1.44 bcd	1.46
7	1.27 a	1.32 cd	1.30
8	1.33 a	1.41 bcd	1.37
9	1.37 a	1.48 abcd	1.42
10	1.31 a	1.57 ab	1.44
11	1.26 a	1.61 ab	1.44
12	1.46 a	1.51 abc	1.49
Mean	0.63	1.46	1.05
<u>1978</u>			
1	1.41 bcd	1.64 cd	1.52
2	1.73 a	1.88 a	1.80
3	1.73 a	1.94 a	1.84
4	1.36 cd	1.52 d	1.44
5	1.33 cd	1.28 e	1.31
6	1.46 bcd	1.66 cd	1.56
7	1.29 d	1.47 d	1.38
8	1.59 abc	1.72 bc	1.66
9	1.37 cd	1.48 d	1.43
10	1.64 ab	1.75 abc	1.70
11	1.45 bcd	1.52 d	1.48
12	1.66 ab	1.64 cd	1.65
Mean	1.51	1.63	1.57
<u>Two Year Average</u>			
1	1.31	1.45	1.38 de
2	1.54	1.72	1.63 ab
3	1.57	1.81	1.69 a
4	1.36	1.46	1.41 de
5	1.35	1.30	1.32 e
6	1.47	1.55	1.51 bcd
7	1.28	1.40	1.34 e
8	1.46	1.56	1.51 bcd
9	1.37	1.48	1.42 de
10	1.48	1.66	1.57 abc
11	1.35	1.56	1.46 cde
12	1.56	1.57	1.57 abc
Mean	1.43	1.55	1.49

TABLE 45
SOYBEAN LEAF MAGNESIUM CONCENTRATIONS (%) AT GAINESVILLE

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.28 a	0.27 bc	0.27
2	0.29 a	0.35 ab	0.32
3	0.33 a	0.43 a	0.38
4	0.29 a	0.27 bc	0.28
5	0.25 a	0.25 c	0.25
6	0.26 a	0.27 bc	0.27
7	0.25 a	0.25 c	0.25
8	0.27 a	0.29 bc	0.28
9	0.29 a	0.30 bc	0.29
10	0.24 a	0.29 bc	0.27
11	0.23 a	0.31 bc	0.27
12	0.27 a	0.30 bc	0.28
Mean	0.27	0.30	0.28
<u>1978</u>			
1	0.36 b	0.50 ab	0.43
2	0.45 a	0.56 a	0.51
3	0.48 a	0.58 a	0.53
4	0.35 bc	0.41 cd	0.38
5	0.34 bc	0.32 d	0.33
6	0.31 bc	0.37 cd	0.34
7	0.28 c	0.36 cd	0.32
8	0.36 b	0.40 cd	0.38
9	0.34 bc	0.36 cd	0.35
10	0.36 bc	0.43 bc	0.40
11	0.30 bc	0.35 cd	0.33
12	0.37 b	0.37 cd	0.37
Mean	*0.36	*0.42	0.39
<u>Two Year Average</u>			
1	0.39	0.32	0.36 b
2	0.46	0.37	0.42 a
3	0.50	0.40	0.46 a
4	0.34	0.32	0.33 bc
5	0.29	0.29	0.29 bc
6	0.32	0.28	0.31 bc
7	0.31	0.27	0.29 c
8	0.34	0.32	0.33 bc
9	0.33	0.31	0.32 bc
10	0.36	0.30	0.33 bc
11	0.33	0.27	0.30 bc
12	0.33	0.32	0.33 bc
Mean	0.32	0.36	0.34

*Indicates systems are significantly different at $p = .05$

TABLE 46

SOYBEAN LEAF NITROGEN CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	4.09 a	3.73 a	3.86
2	4.35 a	3.67 a	4.01
3	4.38 a	3.77 a	4.08
4	3.91 a	3.56 a	3.73
5	4.07 a	3.70 a	3.88
6	4.01 a	3.92 a	3.97
7	4.42 a	3.97 a	4.19
8	3.62 a	3.91 a	3.76
9	4.47 a	4.00 a	4.24
10	4.65 a	4.22 a	4.43
11	4.62 a	3.74 a	4.10
12	4.52 a	3.81 a	4.16
Mean	*4.25	*3.82	4.04
<u>1978</u>			
1	5.02 a	4.96 a	4.99
2	4.95 a	4.75 abc	4.85
3	4.97 a	4.61 bc	4.79
4	4.81 a	4.88 ab	4.84
5	4.85 a	4.72 abc	4.78
6	4.95 a	4.76 abc	4.85
7	4.86 a	4.77 abc	4.82
8	4.86 a	4.62 bc	4.74
9	4.76 a	4.53 c	4.64
10	4.91 a	4.66 bc	4.78
11	4.91 a	4.71 abc	4.81
12	4.92 a	4.85 ab	4.88
Mean	*4.90	*4.73	4.82
<u>Two Year Average</u>			
1	4.55	4.30	4.43 a
2	4.65	4.21	4.43 a
3	4.67	4.19	4.43 a
4	4.36	4.22	4.29 a
5	4.46	4.21	4.33 a
6	4.48	4.34	4.41 a
7	4.64	4.37	4.50 a
8	4.23	4.26	4.25 a
9	4.61	4.26	4.44 a
10	4.78	4.44	4.61 a
11	4.69	4.22	4.45 a
12	4.72	4.33	4.52 a
Mean	*4.57	*4.28	4.42

*Indicates systems are significantly different at p=.05

TABLE 47
SOYBEAN LEAF PHOSPHORUS CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.63 a	0.66 a	0.65
2	0.49 a	0.56 abc	0.53
3	0.46 a	0.44 c	0.45
4	0.48 a	0.58 abc	0.53
5	0.56 a	0.49 bc	0.52
6	0.62 a	0.61 ab	0.61
7	0.60 a	0.50 bc	0.55
8	0.44 a	0.43 c	0.43
9	0.46 a	0.49 bc	0.47
10	0.44 a	0.44 c	0.44
11	0.57 a	0.51 abc	0.54
12	0.57 a	0.42 c	0.49
Mean	0.53	0.51	0.52
<u>1978</u>			
1	0.35 a	0.36 a	0.35
2	0.35 a	0.34 a	0.35
3	0.35 a	0.33 a	0.34
4	0.34 a	0.35 a	0.35
5	0.35 a	0.34 a	0.34
6	0.36 a	0.34 a	0.35
7	0.35 a	0.35 a	0.35
8	0.34 a	0.35 a	0.35
9	0.33 a	0.35 a	0.34
10	0.35 a	0.34 a	0.35
11	0.36 a	0.33 a	0.35
12	0.36 a	0.35 a	0.36
Mean	0.35	0.35	0.35
<u>Two Year Average</u>			
1	0.49	0.51	0.50 a
2	0.42	0.45	0.44 ab
3	0.40	0.39	0.40 ab
4	0.41	0.47	0.44 ab
5	0.46	0.41	0.43 ab
6	0.49	0.48	0.48 ab
7	0.47	0.42	0.45 ab
8	0.39	0.39	0.39 b
9	0.40	0.42	0.41 ab
10	0.39	0.39	0.39 b
11	0.46	0.42	0.44 ab
12	0.46	0.39	0.43 ab
Mean	0.44	0.43	0.43

TABLE 48
SOYBEAN LEAF POTASSIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.61 bc	1.49 ab	1.55
2	1.66 abc	1.39 b	1.53
3	1.69 ab	1.39 b	1.54
4	1.58 bcd	1.43 ab	1.50
5	1.44 d	1.60 a	1.52
6	1.59 bc	1.62 a	1.60
7	1.77 a	1.51 ab	1.64
8	1.69 ab	1.44 ab	1.57
9	1.65 abc	1.40 b	1.52
10	1.54 cd	1.40 b	1.47
11	1.54 cd	1.34 b	1.44
12	1.57 bcd	1.40 b	1.48
Mean	*1.62	*1.46	1.54
<u>1978</u>			
1	1.65 a	1.52 a	1.63
2	1.61 a	1.51 ab	1.56
3	1.56 a	1.43 b	1.50
4	1.62 a	1.53 ab	1.57
5	1.63 a	1.51 ab	1.57
6	1.64 a	1.51 ab	1.58
7	1.63 a	1.62 a	1.63
8	1.67 a	1.53 ab	1.60
9	1.54 a	1.46 b	1.50
10	1.57 a	1.42 b	1.49
11	1.51 a	1.47 b	1.49
12	1.63 a	1.50 ab	1.56
Mean	*1.61	*1.51	1.56
<u>Two Year Average</u>			
1	1.63	1.55	1.59 ab
2	1.63	1.45	1.54 bc
3	1.63	1.41	1.52 bc
4	1.60	1.48	1.54 bc
5	1.54	1.56	1.55 bc
6	1.62	1.56	1.59 ab
7	1.70	1.57	1.63 a
8	1.68	1.49	1.58 ab
9	1.59	1.43	1.51 bc
10	1.55	1.41	1.48 c
11	1.52	1.40	1.46 c
12	1.60	1.45	1.52 bc
Mean	*1.61	*1.48	1.55

*Indicates systems are significantly different at $p=.05$

TABLE 49
SOYBEAN LEAF CALCIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	1.63 a	1.60 a	1.62
2	1.59 a	1.84 a	1.71
3	1.38 a	1.90 a	1.64
4	1.60 a	1.73 a	1.66
5	1.67 a	1.53 a	1.60
6	1.76 a	1.88 a	1.82
7	1.48 a	1.58 a	1.53
8	1.50 a	1.77 a	1.63
9	1.57 a	1.78 a	1.68
10	1.41 a	1.64 a	1.52
11	1.58 a	1.96 a	1.77
12	1.52 a	1.72 a	1.62
Mean	*1.56	*1.75	1.65
<u>1978</u>			
1	1.53 a	1.45 d	1.49
2	1.71 a	1.61 cd	1.66
3	1.76 a	1.84 bc	1.80
4	1.74 a	1.75 bc	1.75
5	1.70 a	1.87 ab	1.78
6	1.60 a	1.75 bc	1.67
7	1.72 a	1.78 bc	1.75
8	1.81 a	1.93 ab	1.87
9	1.88 a	1.77 bc	1.82
10	1.87 a	2.07 a	1.97
11	1.92 a	1.90 ab	1.91
12	1.78 a	1.73 bc	1.76
Mean	1.76	1.79	1.77
<u>Two Year Average</u>			
1	1.58	1.52	1.55 c
2	1.65	1.73	1.69 abc
3	1.57	1.87	1.72 abc
4	1.67	1.74	1.71 abc
5	1.68	1.70	1.69 abc
6	1.68	1.81	1.74 ab
7	1.60	1.68	1.64 bc
8	1.65	1.85	1.75 ab
9	1.72	1.78	1.75 ab
10	1.64	1.86	1.75 ab
11	1.75	1.93	1.84 abc
12	1.65	1.72	1.69 abc
Mean	1.66	1.77	1.71

*Indicates systems are significantly different at p=.05

TABLE 50
SOYBEAN LEAF MAGNESIUM CONCENTRATIONS (%) AT QUINCY

Treatment	System I	System II	Mean
<u>1977</u>			
1	0.33 a	0.33 a	0.33
2	0.29 a	0.34 a	0.32
3	0.26 a	0.36 a	0.31
4	0.30 a	0.32 a	0.31
5	0.32 a	0.27 a	0.30
6	0.30 a	0.33 a	0.32
7	0.26 a	0.27 a	0.26
8	0.27 a	0.31 a	0.29
9	0.28 a	0.31 a	0.30
10	0.24 a	0.29 a	0.26
11	0.28 a	0.33 a	0.30
12	0.27 a	0.30 a	0.28
Mean	0.29	0.32	0.30
<u>1978</u>			
1	0.23 a	0.23 c	0.23
2	0.26 a	0.25 abc	0.26
3	0.25 a	0.28 ab	0.26
4	0.23 a	0.26 abc	0.24
5	0.24 a	0.25 bc	0.24
6	0.21 a	0.23 c	0.22
7	0.22 a	0.25 bc	0.24
8	0.26 a	0.30 a	0.28
9	0.25 a	0.27 abc	0.26
10	0.25 a	0.29 ab	0.27
11	0.26 a	0.26 abc	0.26
12	0.25 a	0.23 c	0.24
Mean	*0.25	*0.26	0.25
<u>Two Year Average</u>			
1	0.28	0.28	0.28 a
2	0.28	0.30	0.29 a
3	0.26	0.32	0.29 a
4	0.26	0.29	0.28 a
5	0.28	0.26	0.27 a
6	0.26	0.28	0.27 a
7	0.24	0.26	0.25 a
8	0.27	0.30	0.29 a
9	0.27	0.29	0.28 a
10	0.24	0.29	0.27 a
11	0.27	0.30	0.29 a
12	0.26	0.27	0.27 a
Mean	*0.27	*0.29	0.28

*Indicates systems are significantly different at $p=.05$

TABLE 51

ANALYSIS OF VARIANCE F VALUES FOR THE EFFECTS OF TWO RATES EACH OF
N, P, AND K ON SOYBEAN LEAF NUTRIENT CONCENTRATIONS (TWO YEAR AVERAGE)

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
<u>Soybean leaf N</u>							
N	1	2.0	4.6*	0.5	2.3	1.0	0.0
P	1	5.2*	1.3	0.9	2.8	5.9*	1.8
K	1	0.3	0.1 ⁺	1.5	1.8	2.0	0.4
N x P	1	0.0	3.9 ⁺	0.9	1.9	0.7	0.2
P x K	1	1.3	1.0	0.0	2.3	1.2	0.3
N ₂ x K	1	0.4	2.0	0.2	1.1	0.0	0.5
R ²		0.71	0.72	0.62	0.66	0.75	0.80
<u>Soybean leaf P</u>							
N	1	2.5	3.9 ⁺	3.5 ⁺	0.0	4.8* ⁺	4.5*
P	1	21.9**	7.3*	0.8	0.1	3.6 ⁺	0.2
K	1	0.0 ⁺	0.3	0.2	2.1	1.7	0.5
N x P	1	3.7 ⁺	0.0 ⁺	0.1	2.2 ⁺	0.1	0.1
P x K	1	1.5	3.8 ⁺	0.3	4.0 ⁺	0.0	0.0
N ₂ x K	1	0.0	1.3	0.0	0.1	0.3	5.6*
R ²		0.86	0.89	0.71	0.80	0.81	0.84
<u>Soybean leaf K</u>							
N	1	0.0	0.8	61.9**	20.0**	1.3	19.6**
P	1	0.3	0.1	11.5**	7.8*	0.0	0.0
K	1	20.4**	23.7**	32.1**	23.7**	1.1	0.0
N x P	1	1.4	1.4	2.0	0.7	16.5**	4.1
P x K	1	1.1	0.8	0.9	0.1 ⁺	5.1*	0.0
N ₂ x K	1	0.2	0.1	8.2**	3.3	2.2	2.2
R ²		0.90	0.94	0.77	0.93	0.75	0.66

⁺ indicates F test is significant at $0.1 < p < .05$.

* indicates F test is significant at $.05 < p < .01$.

** indicates F test is significant at $.01 < p$.

TABLE 51 (continued)

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
<u>Soybean leaf Ca</u>							
N	1	0.4	0.3	3.3 ⁺	18.1**	0.5	6.3*
P	1	0.9	0.0	0.1	8.2**	0.1	1.1
K	1	5.3*	15.0**	12.6**	14.1**	0.4	0.9
N x P	1	0.7	2.4	0.1 ⁺	0.0	0.2	0.3
P x K	1	2.2	0.3	3.4 ⁺	0.0	0.1	0.1
N ₂ x K	1	0.0	0.4	0.0	1.0	1.6	0.8
R		0.93	0.88	0.77	0.83	0.74	0.63
<u>Soybean leaf Mg</u>							
N	1	0.0	2.0	0.7	7.5*	0.0 ⁺	6.7*
P	1	1.5	0.2	11.2**	0.2	3.8 ⁺	0.2
K	1	9.6**	19.7**	4.4	6.9*	0.4	2.3
N x P	1	0.1	2.5	0.0	0.2	0.4	0.1
P x K	1	0.2	0.4	0.5	0.3	0.2	0.7
N ₂ x K	1	0.2	2.0	0.0	0.3	0.5	1.9
R		0.92	0.89	0.81	0.86	0.73	0.63

TABLE 52

SOIL TEST RESULTS FOR SAMPLES TAKEN AT SANFORD DURING CORN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.1 a	1138 a	183 a	3239 a	304 a
2	6.1 a	1069 a	210 a	3206 a	313 a
3	5.9 a	983 a	116 a	2701 a	212 a
4	6.1 a	945 a	143 a	2970 a	237 a
5	6.1 a	1036 a	170 a	3150 a	244 a
6	6.1 a	721 a	141 a	2970 a	233 a
7	5.9 a	1023 a	181 a	3183 a	269 a
8	5.9 a	971 a	141 a	2993 a	230 a
9	6.0 a	906 a	143 a	2780 a	237 a
10	5.9 a	909 a	134 a	2847 a	255 a
11	5.9 a	945 a	174 a	2937 a	233 a
12	6.0 a	842 a	96 a	2611 a	239 a
Mean	6.0	958	153	2965	251
<u>System II (corn forage - soybean)</u>					
1	6.1 ab	1104 a	168 a	3183 a	282 ab
2	6.1 ab	894 a	98 a	2667 a	201 bc
3	6.0 abc	1076 a	188 a	3284 a	327 a
4	6.0 abc	1062 a	154 a	3116 a	260 abc
5	6.0 abc	781 a	71 a	2533 a	204 bc
6	6.1 ab	937 a	165 a	2959 a	242 abc
7	6.3 a	927 a	96 a	2589 a	181 c
8	6.1 ab	948 a	114 a	2959 a	264 abc
9	6.1 ab	948 a	165 a	2937 a	280 abc
10	5.8 d	973 a	150 a	3037 a	278 abc
11	5.9 bcd	859 a	96 a	2645 a	212 bc
12	5.8 cd	1003 a	154 a	2993 a	217 bc
Mean	6.0	962	135	2908	284

TABLE 53

SOIL TEST RESULTS FOR SAMPLES TAKEN AT SANFORD DURING THE SOYBEAN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.1 a	851 bcd	96 d	2690 a	246 a
2	6.1 a	802 cd	103 d	2746 a	280 a
3	5.8 a	775 d	114 d	2623 a	242 a
4	6.0 a	841 bcd	139 cd	2690 a	257 a
5	6.0 a	842 bcd	233 abc	2544 a	269 a
6	6.1 a	960 abc	161 bcd	2533 a	219 a
7	6.2 a	1055 a	271 a	2735 a	282 a
8	6.0 a	871 bcd	150 bcd	2421 a	272 a
9	6.0 a	951 abc	228 abc	2802 a	257 a
10	6.1 a	881 bcd	181 abcd	2656 a	269 a
11	6.0 a	989 ab	244 ab	2970 a	266 a
12	6.0 a	845 bcd	121 d	2634 a	262 a
Mean	6.1	*889	*170	2671	260
<u>System II (corn forage - soybean)</u>					
1	6.0 a	880 a	136 e	2880 a	309 a
2	6.1 a	959 a	132 e	3004 a	325 a
3	6.0 a	873 a	116 e	2858 a	320 a
4	6.0 a	1008 a	183 e	2937 a	264 a
5	6.0 a	957 a	360 a	2847 a	221 a
6	5.9 a	1090 a	199 de	2880 a	280 a
7	6.0 a	1118 a	340 ab	3049 a	282 a
8	6.1 a	1027 a	186 de	2903 a	280 a
9	5.8 a	1012 a	304 abc	2993 a	242 a
10	5.9 a	1082 a	242 cd	3093 a	313 a
11	5.9 a	1152 a	255 cd	3004 a	291 a
12	5.9 a	999 a	190 de	2959 a	271 a
Mean	6.0	*1014	*221	2951	284

*Indicates systems are significantly different at p=.05

TABLE 54
SOIL TEST RESULTS FOR SAMPLES TAKEN AT SANFORD DURING CORN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	5.9 a	836 a	56 e	3037 a	273 a
2	5.6 a	861 a	56 e	3037 a	235 a
3	5.8 a	825 a	58 e	2791 a	174 a
4	5.9 a	811 a	85 de	2690 a	179 a
5	5.9 a	852 a	174 bc	2892 a	230 a
6	5.8 a	926 a	109 de	2791 a	195 a
7	5.9 a	955 a	199 ab	2959 a	237 a
8	5.7 a	834 a	91 de	2701 a	197 a
9	5.9 a	908 a	228 a	2993 a	246 a
10	6.0 a	908 a	114 d	2780 a	201 a
11	5.9 a	933 a	168 bc	2925 a	217 a
12	5.8 a	881 a	123 cd	2813 a	217 a
Mean	5.9	877	122	* 2868	217
<u>System II (corn forage - soybean)</u>					
1	6.0 a	863 a	69 cd	3127 a	286 a
2	5.6 e	865 a	47 d	2993 a	215 a
3	5.7 de	827 a	47 d	2925 a	215 a
4	5.7 de	906 a	85 cd	3004 a	192 a
5	5.7 bcd	979 a	130 bc	3138 a	190 a
6	5.7 de	1008 a	125 bc	3015 a	219 a
7	6.1 a	1002 a	165 ab	3093 a	246 a
8	5.8 bcd	961 a	96 cd	2993 a	210 a
9	5.8 bcd	953 a	210 a	3082 a	226 a
10	6.0 abc	991 a	91 cd	3194 a	273 a
11	5.7 cde	1009 a	174 ab	3026 a	197 a
12	6.0 ab	963 a	127 bc	3295 a	206 a
Mean	5.8	944	114	* 3074	223

*Indicates systems are significantly different at $p=0.05$

TABLE 55
SOIL TEST RESULTS FOR SAMPLES TAKEN AT SANFORD DURING SOYBEAN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
System I (corn grain - soybean)					
1	6.3 a	706 c	56 e	2802 a	217 a
2	6.2 a	858 ab	71 de	2892 a	219 a
3	6.0 a	793 abc	67 de	2802 a	179 a
4	6.1 a	866 a	125 bcd	2824 a	192 a
5	6.1 a	748 bc	139 bc	2802 a	217 a
6	6.0 a	876 a	91 cde	2869 a	188 a
7	6.1 a	863 a	139 bc	2914 a	224 a
8	5.8 a	780 abc	91 cde	2712 a	183 a
9	6.0 a	830 ab	168 b	2757 a	210 a
10	5.9 a	840 ab	103 cde	2667 a	181 a
11	5.9 a	807 abc	145 bc	2712 a	181 a
12	5.8 a	802 abc	264 a	2690 a	201 a
Mean	6.0	815	* 122	* 2788	200
System II (corn forage - soybean)					
1	5.6 a	701 c	82 bcd	2914 a	239 a
2	6.2 a	820 b	65 d	2959 a	206 a
3	6.2 a	791 bc	58 d	2892 a	219 a
4	6.0 a	863 ab	96 bcd	2959 a	206 a
5	6.0 a	856 ab	114 bc	2914 a	212 a
6	6.1 a	903 ab	69 d	3049 a	219 a
7	6.2 a	892 ab	100 bcd	3138 a	228 a
8	6.0 a	861 ab	73 cd	3049 a	204 a
9	6.0 a	901 ab	118 b	3116 a	212 a
10	6.0 a	973 a	91 bcd	3385 a	253 a
11	5.9 a	919 ab	123 b	3071 a	197 a
12	5.8 a	854 ab	215 a	2937 a	212 a
Mean	6.0	862	* 101	* 3032	218

*Indicates systems are significantly different at p=.05

TABLE 56
SOIL TEST RESULTS FOR SAMPLES TAKEN AT GAINESVILLE DURING CORN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	5.6 a	70 a	96 a	450 a	73 a
2	5.7 a	78 a	116 a	511 a	73 a
3	5.8 a	80 a	152 a	703 a	107 a
4	5.7 a	86 a	121 a	517 a	91 a
5	5.7 a	126 a	123 a	591 a	100 a
6	5.8 a	174 a	134 a	780 a	105 a
7	5.8 a	84 a	112 a	553 a	94 a
8	5.8 a	77 a	103 a	547 a	73 a
9	5.7 a	82 a	96 a	573 a	78 a
10	5.7 a	111 a	123 a	605 a	80 a
11	5.8 a	62 a	105 a	542 a	78 a
12	5.8 a	74 a	109 a	520 a	85 a
Mean	5.7	93	116	575	87
<u>System II (corn forage - soybean)</u>					
1	5.9 a	88 a	112 abc	493 a	78 a
2	5.8 a	86 a	76 c	533 a	87 a
3	5.8 a	80 a	91 c	524 a	78 a
4	5.9 a	73 a	112 abc	522 a	85 a
5	5.9 a	85 a	121 abc	594 a	85 a
6	5.8 a	77 a	91 c	475 a	76 a
7	5.9 a	97 a	96 bc	668 a	107 a
8	5.9 a	95 a	147 a	596 a	80 a
9	5.9 a	106 a	82 c	551 a	85 a
10	5.9 a	107 a	139 ab	683 a	103 a
11	5.9 a	84 a	80 c	569 a	91 a
12	5.9 a	96 a	82 c	589 a	91 a
Mean	5.9	90	103	567	88

TABLE 57
SOIL TEST RESULTS FOR SAMPLES TAKEN AT GAINESVILLE DURING SOYBEAN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.0 a	159 a	76 c	1051 a	143 ab
2	5.7 a	174 a	51 c	1307 a	159 a
3	5.6 a	155 a	42 abc	1170 a	125 abc
4	5.7 a	151 a	58 abc	943 a	109 abc
5	5.5 a	151 a	85 ab	1091 a	130 abc
6	5.6 a	153 a	51 abc	993 a	80 bc
7	5.7 a	204 a	85 a	1134 a	123 abc
8	5.5 a	131 a	44 abc	968 a	76 c
9	5.6 a	178 a	53 ab	979 a	89 bc
10	5.4 a	197 a	51 c	946 a	73 c
11	5.3 a	158 a	60 abc	975 a	76 c
12	5.5 a	178 a	76 bc	1212 a	103 abc
Mean	5.6	166	*61	1065	108
<u>System II (corn forage - soybean)</u>					
1	5.9 a	119 c	38 c	1044 abc	141 a
2	5.8 a	142 bc	31 c	1181 a	132 ab
3	5.6 a	130 c	42 bc	1062 abc	96 cd
4	5.8 a	145 bc	47 abc	1179 a	116 abc
5	5.6 a	161 bc	58 ab	1138 ab	118 abc
6	5.6 a	163 bc	44 abc	1004 abc	80 d
7	5.6 a	232 a	62 a	1150 a	100 bcd
8	5.2 a	151 bc	44 abc	899 c	78 d
9	5.6 a	169 bc	58 ab	950 bc	80 d
10	5.3 a	168 bc	38 c	943 bc	71 d
11	5.3 a	186 b	49 abc	1006 abc	82 d
12	5.5 a	134 c	42 bc	948 bc	73 d
Mean	5.6	159	*47	1043	98

*Indicates systems are significantly different at p = .05

TABLE 58
SOIL TEST RESULTS FOR SAMPLES TAKEN AT GAINESVILLE DURING CORN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.0 a	105 a	85 a	831 a	181 a
2	5.9 abc	164 a	76 a	1073 a	201 a
3	5.8 abcd	161 a	78 a	1098 a	215 a
4	5.7 cd	113 a	105 a	733 a	141 a
5	5.9 abcd	106 a	100 a	789 a	156 a
6	5.8 bcd	114 a	80 a	827 a	127 a
7	5.9 a	131 a	121 a	977 a	181 a
8	5.8 bcd	125 a	89 a	977 a	172 a
9	5.7 d	146 a	103 a	878 a	134 a
10	5.7 cd	202 a	105 a	986 a	154 a
11	5.8 bcd	131 a	125 a	1011 a	139 a
12	5.9 abcd	149 a	89 a	865 a	143 a
Mean	5.9	138	97	921	163
<u>System II (corn forage - soybean)</u>					
1	6.1 a	103 b	67 b	773 a	174 a
2	5.9 ab	101 b	49 b	968 a	215 a
3	5.7 c	99 b	60 b	842 a	165 a
4	5.9 bc	112 ab	87 b	908 a	197 a
5	5.9 abc	155 ab	96 b	923 a	177 a
6	5.8 bc	162 ab	109 b	952 a	208 a
7	5.8 bc	142 ab	197 a	988 a	192 a
8	5.7 bc	138 ab	82 b	784 a	152 a
9	5.8 bc	162 ab	103 b	959 a	177 a
10	5.8 bc	171 a	71 b	1051 a	174 a
11	5.8 bc	174 a	91 b	901 a	163 a
12	5.9 a	153 ab	62 b	894 a	159 a
Mean	5.9	140	90	912	180

TABLE 59
SOIL TEST RESULTS FOR SAMPLES TAKEN AT GAINESVILLE DURING THE SOYBEAN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.2 a	106 a	40 a	919 a	130 a
2	6.1 a	134 a	40 a	1143 a	139 a
3	6.1 a	147 a	38 a	1271 a	136 a
4	6.1 a	143 a	71 a	1015 a	105 a
5	6.3 a	128 a	56 a	1026 a	109 a
6	6.2 a	121 a	53 a	941 a	82 a
7	6.1 a	164 a	89 a	1049 a	103 a
8	5.8 a	117 a	35 a	970 a	87 a
9	6.1 a	145 a	80 a	1040 a	100 a
10	6.0 a	158 a	56 a	997 a	96 a
11	6.0 a	105 a	53 a	925 a	80 a
12	6.1 a	98 a	71 a	1255 a	116 a
Mean	6.1	131	57	1046	107
<u>System II (corn forage - soybean)</u>					
1	6.5 a	100 cd	20 bc	968 a	121 a
2	6.2 a	119 bcd	15 c	1096 a	116 a
3	6.1 a	93 d	13 c	896 a	85 a
4	6.3 a	120 bcd	42 ab	1085 a	121 a
5	6.2 a	135 bcd	42 ab	1064 a	100 a
6	6.2 a	139 bc	31 abc	1026 a	94 a
7	6.1 a	180 a	51 a	1132 a	109 a
8	6.0 a	124 bcd	31 abc	964 a	85 a
9	6.2 a	139 bc	42 ab	959 a	82 a
10	6.1 a	145 ab	24 bc	1008 a	76 a
11	6.1 a	154 ab	56 a	1082 a	87 a
12	6.2 a	130 bcd	31 abc	993 a	82 a
Mean	6.2	131	34	1023	97

TABLE 60
SOIL TEST RESULTS FOR SAMPLES TAKEN AT QUINCY DURING THE CORN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.0 a	424 a	309 a	1094 a	356 a
2	6.1 a	480 a	334 a	1123 a	336 a
3	6.1 a	444 a	316 a	1033 a	347 a
4	6.1 a	399 a	327 a	867 a	334 a
5	6.1 a	424 a	343 a	1011 a	356 a
6	6.1 a	419 a	340 a	1107 a	387 a
7	6.1 a	389 a	304 a	872 a	282 a
8	6.0 a	445 a	304 a	1022 a	318 a
9	6.1 a	378 a	313 a	1076 a	408 a
10	6.1 a	356 a	322 a	1194 a	410 a
11	6.1 a	443 a	291 a	1087 a	340 a
12	6.2 a	463 a	318 a	1105 a	327 a
Mean	6.1	422	319	*1050	350
<u>System II (corn forage - soybean)</u>					
1	6.1 a	377 a	275 a	876 a	354 a
2	6.1 a	450 a	307 a	896 a	307 a
3	6.1 a	367 a	266 a	948 a	320 a
4	6.1 a	444 a	282 a	766 a	246 a
5	6.1 a	406 a	295 a	786 a	271 a
6	6.1 a	397 a	273 a	1026 a	316 a
7	6.1 a	373 a	284 a	856 a	284 a
8	6.1 a	375 a	293 a	959 a	351 a
9	6.0 a	456 a	284 a	719 a	244 a
10	6.1 a	414 a	293 a	881 a	338 a
11	6.1 a	415 a	293 a	890 a	327 a
12	6.0 a	435 a	260 a	715 a	255 a
Mean	6.1	410	284	*860	301

*indicates systems are significantly different at $p = .05$.

TABLE 61
SOIL TEST RESULTS FOR SAMPLES TAKEN AT QUINCY DURING THE SOYBEAN GROWING SEASON, 1977

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
System I (corn grain - soybean)					
1	5.8 a	366 a	152 de	1383 a	132 a
2	5.5 a	389 a	141 e	1226 a	82 a
3	5.5 a	364 a	177 cde	1087 a	85 a
4	5.5 a	380 a	186 bcde	1203 a	98 a
5	5.6 a	349 a	255 a	1282 a	107 a
6	5.7 a	461 a	201 abcd	1403 a	107 a
7	5.4 a	449 a	228 abc	1318 a	91 a
8	5.4 a	446 a	201 abcd	1203 a	82 a
9	5.4 a	376 a	210 abc	1208 a	107 a
10	5.2 a	431 a	190 bcde	1242 a	89 a
11	5.3 a	466 a	206 abcd	1320 a	127 a
12	5.5 a	415 a	235 ab	1217 a	123 a
Mean	5.5	*408	*199	*1258	103
System II (corn forage - soybean)					
1	5.7 a	309 c	143 a	1078 a	118 a
2	5.6 a	323 bc	143 a	1152 a	100 a
3	5.5 a	324 bc	112 a	1096 a	103 a
4	5.4 a	344 bc	150 a	1064 a	80 a
5	5.5 a	335 bc	192 a	1022 a	107 a
6	5.4 a	410 b	150 a	1210 a	82 a
7	5.4 a	390 bc	188 a	1147 a	82 a
8	5.5 a	316 bc	204 a	1105 a	107 a
9	5.4 a	350 bc	172 a	1103 a	89 a
10	5.3 a	386 bc	165 a	1121 a	85 a
11	5.2 a	500 a	208 a	1423 a	125 a
12	5.3 a	368 bc	156 a	1087 a	109 a
Mean	5.5	*364	*166	*1134	100

*Indicates systems are significantly different at p=.05

TABLE 62
SOIL TEST RESULTS FOR SAMPLES TAKEN AT QUINCY DURING CORN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
System I (corn grain - soybean)					
1	6.2 a	367 a	264 a	2161 a	473 a
2	6.2 ab	378 a	278 a	2569 a	547 a
3	6.3 c	398 a	293 a	2818 a	656 a
4	6.4 bc	398 a	278 a	1860 a	399 a
5	6.3 abc	361 a	264 a	2058 a	378 a
6	6.3 bc	445 a	273 a	2564 a	502 a
7	6.3 bc	420 a	278 a	2611 a	542 a
8	6.3 bc	409 a	316 a	2206 a	484 a
9	6.2 bc	398 a	298 a	1739 a	403 a
10	6.3 bc	386 a	284 a	1990 a	437 a
11	6.3 bc	437 a	291 a	2033 a	464 a
12	6.3 bc	389 a	286 a	2611 a	520 a
Mean	6.3	*399	284	2269	485
System II (corn forage - soybean)					
1	6.4 a	347 a	260 a	2874 a	513 a
2	6.4 a	350 a	235 a	2230 a	437 a
3	6.4 a	347 a	235 a	2300 a	437 a
4	6.3 a	387 a	255 a	1858 a	369 a
5	6.4 a	350 a	280 a	2585 a	569 a
6	6.4 a	367 a	251 a	2618 a	437 a
7	6.4 a	350 a	278 a	2183 a	365 a
8	6.4 a	330 a	289 a	2506 a	553 a
9	6.3 a	316 a	251 a	2210 a	347 a
10	6.3 a	367 a	257 a	2802 a	466 a
11	6.3 a	378 a	264 a	2558 a	522 a
12	6.3 a	345 a	242 a	2650 a	412 a
Mean	6.4	*353	258	2248	453

*Indicates systems are significantly different at p=.05

TABLE 63

SOIL TEST RESULTS FOR SAMPLES TAKEN AT QUINCY DURING THE SOYBEAN GROWING SEASON, 1978

Treatment	pH	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	Mg (kg/ha)
<u>System I (corn grain - soybean)</u>					
1	6.2 a	341 bcd	304 a	2340 a	188 a
2	6.2 a	280 d	383 a	2607 a	186 ab
3	6.3 a	414 ab	349 a	2094 a	141 abc
4	6.4 a	316 bcd	365 a	1894 a	134 c
5	6.3 a	372 abcd	412 a	1677 a	132 c
6	6.3 a	482 a	439 a	2300 a	143 abc
7	6.3 a	324 bcd	455 a	2064 a	134 c
8	6.3 a	327 bcd	448 a	1706 a	125 c
9	6.2 a	403 abc	490 a	1611 a	132 c
10	6.3 a	375 abcd	365 a	1688 a	125 c
11	6.3 a	305 bcd	390 a	1910 a	139 bc
12	6.3 a	291 cd	304 a	2058 a	168 abc
Mean	6.3	352	392	1196	146
<u>System II (corn forage - soybean)</u>					
1	6.4 a	302 a	242 a	1863 a	150 a
2	6.4 a	282 a	304 a	1824 a	152 a
3	6.4 a	313 a	150 a	1228 a	125 a
4	6.3 a	330 a	331 a	1443 a	121 a
5	6.4 a	313 a	271 a	1504 a	116 a
6	6.4 a	375 a	273 a	1670 a	114 a
7	6.4 a	389 a	219 a	1919 a	132 a
8	6.4 a	282 a	253 a	1842 a	139 a
9	6.3 a	291 a	253 a	1358 a	116 a
10	6.3 a	336 a	273 a	1385 a	118 a
11	6.3 a	299 a	381 a	1452 a	123 a
12	6.3 a	308 a	298 a	1446 a	118 a
Mean	6.4	319	271	1578	127

TABLE 64

SOIL TEST VALUES TAKEN DURING THE SOYBEAN GROWING SEASON 1978 AS INFLUENCED
BY THREE RATES OF NITROGEN APPLIED OVER A TWO YEAR PERIOD

Location	System	N applied (kg/ha)	pH	Soil Test Value (kg/ha)			
				P	K	Ca	Mg
Sanford	1	0	6.3 a	706 b	56 a	2802 a	217 a
		168	6.2 a	858 a	71 a	2892 a	219 a
		280	6.0 a	793 ab	67 a	2802 a	179 a
	2	0	5.6 a	701 b	82 a	2914 a	192 a
		168	6.2 a	820 a	65 a	2959 a	217 a
		280	6.2 a	791 ab	82 a	2892 a	188 a
Gainesville	1	0	6.2 a	106 a	40 a	919 a	130 a
		168	6.1 a	134 a	40 a	1143 a	139 a
		280	6.1 a	147 a	38 a	1271 a	136 a
	2	0	6.5 a	100 a	20 a	968 a	121 a
		168	6.2 a	119 a	15 a	1096 a	116 a
		280	6.1 a	93 a	13 a	896 a	85 a
Quincy	1	0	6.2 a	341 ab	304 a	2340 a	188 a
		168	6.3 a	280 b	383 a	2607 a	186 a
		280	6.3 a	414 a	349 a	2094 a	141 a
	2	0	6.4 a	302 a	242 a	1863 a	150 a
		168	6.4 a	282 a	304 a	1824 a	152 a
		280	6.4 a	313 a	150 a	1228 a	125 a

TABLE 65

ANALYSIS OF VARIANCE F VALUES FOR THE EFFECTS OF TWO RATES EACH OF N, P, AND K ON SOIL TEST VALUES
OF SAMPLES TAKEN DURING THE SOYBEAN GROWING SEASON, 1978

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
		<u>Soil pH</u>					
N	1	8.7**	3.8 ⁺	27.5**	3.8 ⁺	3.6 ⁺	0.2
P	1	0.1	0.2	0.3	0.4	0.6	0.2
K	1	2.4	2.0	10.9**	0.2	0.6	0.2
N x P	1	1.1	0.0	3.1	0.8	0.6	2.7
P x K	1	0.0	1.1	13.6**	0.2	1.3	0.0
N x K	1	0.4	0.0	1.9	2.0	0.0	0.7
<u>Soil P</u>							
N	1	1.7 ⁺	0.8	0.6	0.2	0.7	4.8* ⁺
P	1	3.1 ⁺	0.4	0.2	7.5*	0.4	4.1 ⁺
K	1	1.7	17.6**	0.0	4.9*	0.9	0.1
N x P	1	1.2	4.4*	0.1	0.6	2.7	0.4
P x K	1	0.0 ⁺	0.0	0.3	0.3	12.2**	0.0
N x K	1	3.5 ⁺	0.8	1.6	0.8	1.1	0.0
<u>Soil K</u>							
N	1	0.1	1.9	1.6	0.3	0.0	0.3
P	1	1.0	4.2*	0.1 ⁺	0.0	0.3	0.1
K	1	15.7**	0.1	3.2 ⁺	5.7*	1.0	0.0 ⁺
N x P	1	0.3	0.3	0.4	0.1	5.1*	4.2 ⁺
P x K	1	0.0	1.0	0.0	2.3	0.1	0.8
N x K	1	1.7	0.0	0.4	0.7	0.0	3.1

⁺ indicates F test is significant at 0.1 < p < .05.

* indicates F test is significant at .05 < p < .01.

** indicates F test is significant at .01 < p.

TABLE 65 (continued)

Source	df	Sanford		Gainesville		Quincy	
		System I	System II	System I	System II	System I	System II
<u>Soil Ca</u>							
N	1	2.7	2.4	0.2	1.1	3.1 ⁺	1.3
P	1	0.0	2.8	0.3	0.4	3.5 ⁺	0.4
K	1	0.1	0.3	0.2	0.3	0.3	0.0
N x P	1	0.5	0.0	0.0	0.3	0.8	5.3*
P x K	1	0.0	0.5	0.0	0.5	0.3	3.0
N x K	1	0.0	0.7	0.3	0.0	1.0	2.8
<u>Soil Mg</u>							
N	1	1.3	0.0	1.4	0.0	0.7	0.2
P	1	0.3	2.4	1.8	0.5	0.5	0.1
K	1	2.3	0.6	0.5	0.9	0.1	0.0
N x P	1	0.3	0.0	0.4	0.7	0.0	0.7 ⁺
P x K	1	0.1	2.4	0.2	0.2	0.0	3.5 ⁺
N x K	1	0.3	2.4	0.8	0.7	1.4	1.4

TABLE 66
NUTRIENT CONCENTRATIONS IN CORN FORAGE
GROWN DURING 1977 AND 1978 AT SANFORD, FLORIDA

Treatment	Nutrient Concentrations in Corn Forage (%)				
	N	P	K	Ca	Mg
<u>1977</u>					
1	0.88 c	0.28 a	1.35 a	0.19 a	0.23 a
2	1.35 b	0.21 bc	0.83 a	0.19 a	0.20 a
3	1.48 ab	0.20 c	1.15 a	0.28 a	0.24 a
4	1.45 ab	0.25 ab	1.20 a	0.25 a	0.22 a
5	1.48 ab	0.22 bc	1.28 a	0.27 a	0.20 a
6	1.36 b	0.21 bc	1.07 a	0.28 a	0.25 a
7	1.33 b	0.23 bc	1.24 a	0.29 a	0.22 a
8	1.68 a	0.21 bc	0.97 a	0.28 a	0.21 a
9	1.62 ab	0.23 bc	1.28 a	0.28 a	0.21 a
10	1.53 ab	0.25 ab	1.00 a	0.21 a	0.17 a
11	1.51 ab	0.22 bc	1.42 a	0.33 a	0.22 a
12	1.57 ab	0.21 bc	1.30 a	0.27 a	0.21 a
Mean	1.44	0.23	1.18	0.26	0.21
<u>1978</u>					
1	0.70 d	0.25 a	0.94 abc	0.15 c	0.23 c
2	0.96 cd	0.24 a	0.87 bc	0.33 ab	0.35 ab
3	1.38 ab	0.22 a	0.60 c	0.33 ab	0.38 a
4	1.23 abc	0.22 a	0.70 c	0.27 ab	0.26 bc
5	1.21 abc	0.23 a	1.09 ab	0.26 b	0.20 c
6	1.21 abc	0.25 a	0.86 bc	0.30 ab	0.28 bc
7	1.06 bc	0.22 a	1.11 ab	0.32 ab	0.23 c
8	1.34 ab	0.21 a	1.12 ab	0.38 a	0.28 bc
9	1.46 a	0.24 a	1.25 a	0.34 ab	0.20 c
10	1.36 ab	0.25 a	1.16 ab	0.35 ab	0.25 bc
11	1.28 abc	0.26 a	1.25 a	0.34 ab	0.20 c
12	1.33 ab	0.22 a	1.04 ab	0.33 ab	0.23 c
Mean	1.21	0.23	1.00	0.31	0.26

TABLE 67
NUTRIENT CONCENTRATIONS IN CORN FORAGE
GROWN DURING 1977 AND 1978 AT GAINESVILLE, FLORIDA

Treatment	Nutrient Concentrations in Corn Forage (%)			
	N	P	K	Ca Mg
<u>1977</u>				
1	0.76 e	0.29 a	0.97 def	0.19 a 0.23 bc
2	1.34 bcd	0.19 c	0.69 f	0.26 a 0.27 a
3	1.62 a	0.20 bc	0.74 ef	0.24 a 0.26 ab
4	1.32 cd	0.21 bc	1.01 cde	0.21 a 0.19 cd
5	1.37 bcd	0.19 bc	1.37 ab	0.23 a 0.17 d
6	1.28 d	0.20 bc	1.11 abcd	0.26 a 0.23 abc
7	1.42 abcd	0.21 bc	1.38 a	0.22 a 0.18 cd
8	1.52 abc	0.20 bc	1.06 bcde	0.25 a 0.21 cd
9	1.61 a	0.21 bc	1.30 abc	0.23 a 0.21 cd
10	1.64 a	0.22 b	1.05 bcde	0.26 a 0.21 cd
11	1.62 a	0.22 bc	1.05 bcde	0.23 a 0.21 cd
12	1.57 ab	0.22 b	0.90 def	0.25 a 0.22 bcd
Mean	1.43	0.21	1.06	0.24 0.22
<u>1978</u>				
1	0.54 d	0.27 a	0.77 bcde	0.21 bcde 0.21 bc
2	0.87 c	0.20 bc	0.52 e	0.22 bcde 0.23 ab
3	1.08 ab	0.18 c	0.50 e	0.29 a 0.26 a
4	0.85 c	0.19 bc	0.75 cde	0.24 bcd 0.18 cd
5	1.22 a	0.21 bc	1.05 a	0.24 abcd 0.16 d
6	0.85 c	0.18 bc	0.76 bcde	0.25 abc 0.17 cd
7	1.13 ab	0.21 bc	1.03 ab	0.26 ab 0.18 cd
8	1.04 abc	0.18 c	0.69 de	0.21 bcde 0.19 bcd
9	1.01 bc	0.19 bc	0.97 abc	0.18 de 0.18 cd
10	1.00 bc	0.19 bc	0.60 e	0.19 cde 0.19 bcd
11	1.18 ab	0.20 bc	0.94 abcd	0.17 e 0.16 d
12	1.04 abc	0.23 ab	0.74 cde	0.21 bcde 0.20 bcd
Mean	0.98	0.20	0.78	0.22 0.19

TABLE 68
NUTRIENT CONCENTRATIONS IN CORN FORAGE
GROWN DURING 1977 AND 1978 AT QUINCY, FLORIDA

Treatment	Nutrient Concentrations in Corn Forage (%)				
	N	P	K	Ca	Mg
<u>1977</u>					
1	1.06 d	0.22 abc	1.19 ef	0.14 bcd	0.11 a
2	1.25 b	0.20 bc	1.37 f	0.13 d	0.12 a
3	1.42 a	0.20 bc	1.35 f	0.15 bcd	0.12 a
4	1.21 bc	0.20 bc	1.86 bcde	0.14 bcd	0.11 a
5	1.22 bc	0.22 abc	1.60 abcd	0.14 bcd	0.11 a
6	1.11 cd	0.24 a	1.64 bcde	0.15 bcd	0.11 a
7	1.07 d	0.21 bc	1.84 a	0.18 ab	0.12 a
8	1.18 bcd	0.19 c	1.47 def	0.13 cd	0.12 a
9	1.32 ab	0.20 bc	1.47 cdef	0.15 abcd	0.12 a
10	1.29 ab	0.23 ab	1.52 bcdef	0.16 abcd	0.11 a
11	1.24 bc	0.22 abc	1.51 ab	0.17 abc	0.11 a
12	1.21 bc	0.19 c	1.30 abc	0.19 a	0.11 a
Mean	1.22	0.22	1.48	0.16	0.12
<u>1978</u>					
1	0.78 c	0.29 a	1.31 a	0.18 a	0.14 a
2	1.22 ab	0.18 cde	1.22 a	0.16 a	0.12 a
3	1.29 ab	0.17 de	1.27 a	0.15 a	0.11 a
4	1.20 ab	0.24 ab	1.54 a	0.17 a	0.12 a
5	1.26 ab	0.18 cde	1.59 a	0.19 a	0.13 a
6	1.33 ab	0.19 cde	1.55 a	0.18 a	0.12 a
7	1.31 ab	0.22 bc	1.82 a	0.18 a	0.11 a
8	1.36 a	0.18 cde	1.34 a	0.17 a	0.12 a
9	1.28 ab	0.16 de	1.36 a	0.15 a	0.10 a
10	1.35 ab	0.16 e	1.42 a	0.14 a	0.09 a
11	1.18 b	0.18 cde	1.63 a	0.13 a	0.10 a
12	1.27 ab	0.21 bcd	1.61 a	0.20 a	0.20 a
Mean	1.24	0.20	1.51	0.16	0.12

TABLE 69
NUTRIENTS REMOVED IN CORN FORAGE DURING 1977 AND 1978 AT SANFORD, FLORIDA

Treatment	Nutrient Removal (kg/ha)				
	N	P	K	Ca	Mg
<u>1977</u>					
1	22 b	7 a	33 a	4 c	5 a
2	55 a	8 a	33 a	7 bc	7 a
3	63 a	8 a	52 a	11 ab	10 a
4	54 a	9 a	47 a	9 ab	7 a
5	54 a	8 a	47 a	9 ab	7 a
6	43 a	7 a	34 a	8 b	7 a
7	49 a	8 a	45 a	10 ab	7 a
8	55 a	7 a	31 a	8 b	6 a
9	60 a	8 a	47 a	10 ab	7 a
10	60 a	10 a	39 a	7 bc	6 a
11	61 a	9 a	58 a	13 a	8 a
12	60 a	8 a	50 a	10 ab	7 a
Mean	53	8	43	9	7
<u>1978</u>					
1	23 c	8 b	33 e	5 c	7 c
2	77 b	18 a	74 bcd	24 ab	26 ab
3	101 ab	16 a	43 de	24 ab	27 a
4	115 ab	21 a	64 cde	24 ab	24 ab
5	106 ab	20 a	97 abc	22 b	17 abc
6	103 ab	21 a	74 bcd	25 ab	23 ab
7	101 ab	21 a	107 ab	29 ab	21 ab
8	119 ab	19 a	104 ab	33 a	23 ab
9	113 ab	19 a	98 ab	24 ab	15 bc
10	130 a	23 a	112 a	33 ab	24 ab
11	111 ab	23 a	109 ab	29 ab	17 abc
12	129 a	21 a	102 ab	32 ab	22 ab
Mean	102	19	85	26	21

TABLE 70

NUTRIENTS REMOVED IN CORN FORAGE DURING 1977 AND 1978 AT GAINESVILLE, FLORIDA

Treatment	Nutrient Removal (kg/ha)			
	N	P	K	Mg
<u>1977</u>				
1	13 c	5 b	17 d	3 b
2	87 ab	12 a	46 bc	17 a
3	84 ab	10 a	39 c	12 a
4	81 ab	13 a	62 abc	12 a
5	82 ab	12 a	83 a	13 a
6	78 ab	12 a	68 a	15 a
7	82 ab	12 a	76 a	13 a
8	83 ab	11 a	58 abc	13 a
9	85 ab	10 a	62 abc	10 a
10	94 ab	13 a	63 abc	15 a
11	112 a	15 a	72 a	16 a
12	72 b	10 a	43 bc	11 a
Mean	79	11	57	13
<u>1978</u>				
1	18 g	9 d	26 g	7 c
2	62 f	15 bc	37 efg	15 b
3	71 def	12 cd	33 fg	19 ab
4	69 def	15 bc	60 cde	19 ab
5	104 ab	18 ab	91 a	21 a
6	67 ef	15 bc	61 cde	20 ab
7	90 bc	17 ab	83 abc	20 ab
8	86 cd	15 bc	56 def	17 ab
9	89 bc	17 ab	86 ab	16 ab
10	82 cde	15 bc	49 defg	15 ab
11	108 a	18 ab	84 abc	15 b
12	89 bc	21 a	65 bcd	18 ab
Mean	78	15	61	17

TABLE 71
NUTRIENTS REMOVED IN CORN FORAGE DURING 1977 AND 1978 AT QUINCY, FLORIDA

Treatment	Nutrient Removal (kg/ha)				
	N	P	K	Ca	Mg
<u>1977</u>					
1	86 e	18 a	105 d	11 d	9 d
2	131 b	22 a	127 cd	13 cd	12 bcd
3	155 a	22 a	142 bcd	16 abcd	13 b
4	108 cd	18 a	137 cd	12 d	9 d
5	122 bcd	22 a	159 abc	14 abcd	11 bcd
6	103 de	23 a	144 bcd	14 bcd	10 cd
7	113 bcd	22 a	192 a	19 ab	12 bc
8	161 a	26 a	183 ab	18 abc	16 a
9	130 bc	20 a	134 cd	15 abde	12 bcd
10	130 bc	23 a	143 bcd	16 abcd	11 bcd
11	114 bcd	21 a	151 abc	16 abcd	10 cd
12	121 bcd	19 a	163 abc	19 a	10 bcd
Mean	123	21	149	15	11
<u>1978</u>					
1	35 c	13 a	53 b	8 a	6 a
2	90 ab	14 a	103 a	11 a	9 a
3	96 ab	13 a	102 a	11 a	8 a
4	89 ab	18 a	139 a	12 a	8 a
5	85 b	12 a	110 a	12 a	8 a
6	99 ab	14 a	122 a	13 a	8 a
7	96 ab	16 a	134 a	13 a	8 a
8	103 ab	14 a	112 a	12 a	9 a
9	90 ab	11 a	102 a	10 a	7 a
10	112 a	13 a	128 a	12 a	7 a
11	83 b	13 a	109 a	9 a	7 a
12	99 ab	17 a	94 ab	16 a	17 a
Mean	90	14	109	12	8

CORN PLANT POPULATIONS AT HARVEST FOR EACH LOCATION AND YEAR IN THE CORN-SOYBEAN SUCCESSION CROPPING SYSTEM STUDY

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APPENDIX 2
CORN HEIGHT MEASUREMENTS (cm) AT THREE LOCATIONS IN FLORIDA DURING 1977 AND 1978

Treatment	Short season hybrid (grain)		Full season hybrid (forage)	
	Sanford	Gainesville	Sanford	Quincy
<u>1977</u>				
1	65.0 a	69 d	72.5 b	71 c
2	78.8 a	100 abc	100.0 a	113 ab
3	65.0 a	94 c	95.0 a	103 ab
4	76.3 a	109 abc	95.8 a	125 ab
5	78.3 a	110 abc	84.3 ab	118 ab
6	79.5 a	114 a	84.3 ab	118 ab
7	77.5 a	110 abc	93.8 a	113 ab
8	73.8 a	118 a	93.3 a	128 a
9	73.8 a	104 abc	96.3 a	111 ab
10	76.3 a	105 abc	93.8 a	110 ab
11	74.5 a	109 abc	96.3 a	121 ab
12	713. a	98 bc	88.8 ab	115 ab
Mean	74.0	103	91.0	112
<u>1978</u>				
1	76 c	79 b	81 b	69 d
2	105 b	107 ab	113 a	117 bc
3	94 b	104 ab	111 a	116 c
4	132 a	114 a	108 a	133 a
5	134 a	113 a	109 a	134 a
6	135 a	118 a	111 a	130 abc
7	135 a	111 a	100 a	130 abc
8	132 a	108 ab	103 a	129 abc
9	130 a	106 ab	108 a	131 a
10	130 a	117 a	110 a	121 abc
11	140 a	116 a	111 a	132 a
12	136 a	113 a	105 a	130 abc
Mean	123	109	106	123

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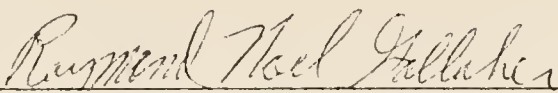
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BIOGRAPHICAL SKETCH

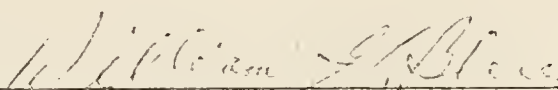
Michael D. Read, Jr. was born 16 October 1953, in Coaldale, Pennsylvania. He received his early schooling in Pennsylvania, Florida, and Connecticut. In 1971 he entered Worcester Polytechnic Institute in Worcester, Massachusetts and studied engineering until 1973 when he transferred to the University of Florida. In June 1976, he completed his B.S. degree in Forest Resources and Conservation with a major in wildlife ecology. In January 1979, he began graduate studies in Agronomy and is now a candidate for the Master of Science degree.

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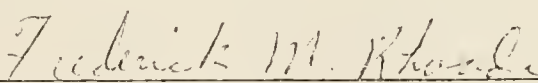
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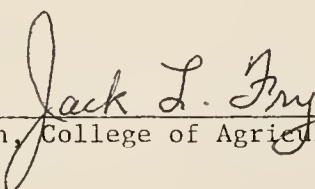

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